

GSReg: A Package for Gene Set Variability Analysis

Bahman Afsari¹ and Elana J. Fertig¹

¹The Sidney Kimmel Comprehensive Cancer Center,
Johns Hopkins University School of Medicine

Modified: April 8, 2014. Compiled: April 24, 2017

Contents

1	Introduction	1
2	Input Data	2
2.1	Data structure	2
3	Analysis of the pathways	4
3.1	DIRAC Analysis	5
3.2	EVA	6
3.3	Comparison of DIRAC and EVA	10
3.4	Splice-EVA Analysis	25
4	System Information	75
5	Literature Cited	75

1 Introduction

The **GSReg** package allows to analyze pathways based on the variability of the expression of sets of genes that are targets of those pathways. Basing this set statistic on variability enables inference of dysregulated pathways in diseases, including notably cancers. The first set statistic for gene variability was in the work of Eddy and his colleagues (see [1]) which used a ranked based methodology called *DIRAC*. *DIRAC* calculates a measure of variability of the ordering of the expression of genes in a pathway for specific phenotype. The basic idea

behind *DIRAC* is to generate a template for the pair-wise comparisons of gene expressions of a pathway within a phenotype. *DIRAC* calculates a measure of the variability of the ordering within the phenotype, i.e. the expected distance of a sample from the phenotype and the template of the phenotype. In mathematical terms, if we denote two i.i.d. samples from the same phenotypes by X and X' and D Kendall- τ -distance on the specific pathways, then the EVA [?] statistic is $E(D(X, X'))$. It identifies significantly dysregulated pathways by estimating p-values from a permutation test. Eddy et al. found that more pathological phenotypes usually have more pathways with higher variability compared to less pathological phenotypes.

However, the permutation test in *DIRAC* is computationally intensive and reaching low p-values may be impractical since they require a huge number of permutations. Low p-values are required for multiple hypothesis correction. A similar measure of variability of the orderings of gene sets was proposed in [2]. This method approximates the p-value theoretically, without a permutation test. This method is based on Kendall- τ distance [3] and the theory of U-Statistics, thus we call this method Gene Set Expression Variation Analysis (or in short EVA). Specifically, Kendall- τ distance between two expression profiles counts the number of disagreeing pairwise comparisons between two profiles. The EVA measures the variability of the gene expression of pathway genes from a phenotype by calculating the expectation of Kendall- τ distance between two random samples from the phenotype. EVA then identifies if the variability is significantly different across two phenotypes. To approximate this p-value EVA applies a U-Statistic Theory approach.

The **GReg** package contains two following utilities:

1. Identifying the dysregulated pathways with *DIRAC* measure of variability. The significance is calculated using permutation test. This is the first time that *DIRAC* analysis has been implemented in *R*. It also is more adaptable to new datasets than the original Matlab code in [1].
2. Identifying the dysregulated pathways with *EVA* measure of variability. The significance is approximated through applying U-statistics theory. This is very time efficient and consistent with both *DIRAC* and applying permutation test on EVA.

2 Input Data

2.1 Data structure

In short, the **GReg** package requires the following data in the following format:

1. Gene Expression Data

- (a) The expression be in the form of a matrix where rows represent genes (or probes) and columns represent samples.
- (b) The expression matrix cannot have NAs.
- (c) The expression matrix rows must have names of genes or the probes.

2. Pathways

- (a) The list of pathways must contain character vectors. Only the elements of the vectors which appear in rownames of the expression matrix are considered for analysis.
- (b) The list of the pathways must have names for each vectors.

3. Phenotypes

- (a) A factor with binary levels.

We used the data provided in the **GSBenchMark** package to reproduce the results in Eddy et al. [1]. The **GSBenchMark** contains data for the pathways as well as the gene expression and phenotype data from twelve studies. We load the information about the pathways from

GSBenchMark:

```
> library(GSBenchMark)
> data(diracpathways)
> class(diracpathways)

[1] "list"

> names(diracpathways)[1:5]

[1] "DEATHPATHWAY"      "TCAPOPTOSISPATHWAY" "CCR3PATHWAY"
[4] "NEUTROPHILPATHWAY" "ALTERNATIVEPATHWAY"

> class(diracpathways[[1]])

[1] "character"
```

AS mentioned **GSReg** package requires the information of the pathways to be as a list of character vectors. Also, **GSReg** requires the pathways to have names. The variable **diracpathways** contains gene pathways. It is a list. Each element represents a pathway with its name. Each elements contains a list of characters which represent the genes in the pathway. e.g. `diracpathways[["DEATHPATHWAY"]]`.

Now, we load the datasets' names:

```

> data(GSBenchMarkDatasets)
> print(GSBenchMark.Dataset.names)

[1] "leukemia_GSEA"          "marfan_GDS2960"          "melanoma_GDS2735"
[4] "parkinsons_GDS2519"    "prostate_GDS2545_m_nf"  "prostate_GDS2545_m_p"
[7] "prostate_GDS2545_p_nf" "sarcoma_data"           "squamous_GDS2520"
[10] "breast_GDS807"         "bipolar_GDS2190"

```

The remaining examples in this vignette rely on one of the datasets, i.e. “squamous GDS2520.” Similar analyses may be reproduced for other datasets by selecting a different element of “GS-BenchMark.Dataset.names.”

```

> DataSetStudy = GSBenchMark.Dataset.names[[9]]
> print(DataSetStudy)

[1] "squamous_GDS2520"

> data(list=DataSetStudy)

```

The data consists of two variables: **exprsdata** and **phenotypes**. **exprsdata** consists of a gene expression matrix where the rows and columns represent genes and the samples respectively. **GSReg** requires the rownames of gene expression variable represent the gene names, *i.e.* they are represented in the pathway information variable.

The **GSReg** does not allow any missing data. To comply with the requirements we remove genes with NAs. The user may use any imputation to resolve this issue:

```

> if(sum(apply(is.nan(exprsdata),1,sum)>0))
  exprsdata = exprsdata[-which(apply(is.nan(exprsdata),1,sum)>0),];

```

One can extract the gene names by:

```

> genenames = rownames(exprsdata);
> genenames[1:10]

[1] "MAPK3"    "TIE1"    "CYP2C19" "CXCR5"   "CXCR5"   "DUSP1"   "MMP10"   "DDR1"
[9] "EIF2AK2" "HINT1"

```

3 Analysis of the pathways

Here, we demonstrate how to use the **GSReg** package to compute DIRAC and EVA statistics.

3.1 DIRAC Analysis

First, we load the library:

```
> library(GSReg)
```

The package also implements the alternative EVA statistic in the function `GSReg.GeneSets.DIRAC`. This function receives gene expression as `geneexpres`, the pathway information as `pathways` and phenotypes of samples as a factor with two levels and length equal to column number of `geneexpres`. *DIRAC* uses can use either a permutation test or normal approximation for p-value calculation; so, `GSReg.GeneSets.DIRAC` receives the number of permutations through (`Nperm`) with default value equal to 0 which indicates the normal approximation.

```
> Nperm = 10
> system.time({DIRACperm =GSReg.GeneSets.DIRAC(exprsdata,diracpathways,phenotypes,Nperm=Nperm)})
   user  system elapsed 
4.626   0.374   5.143 

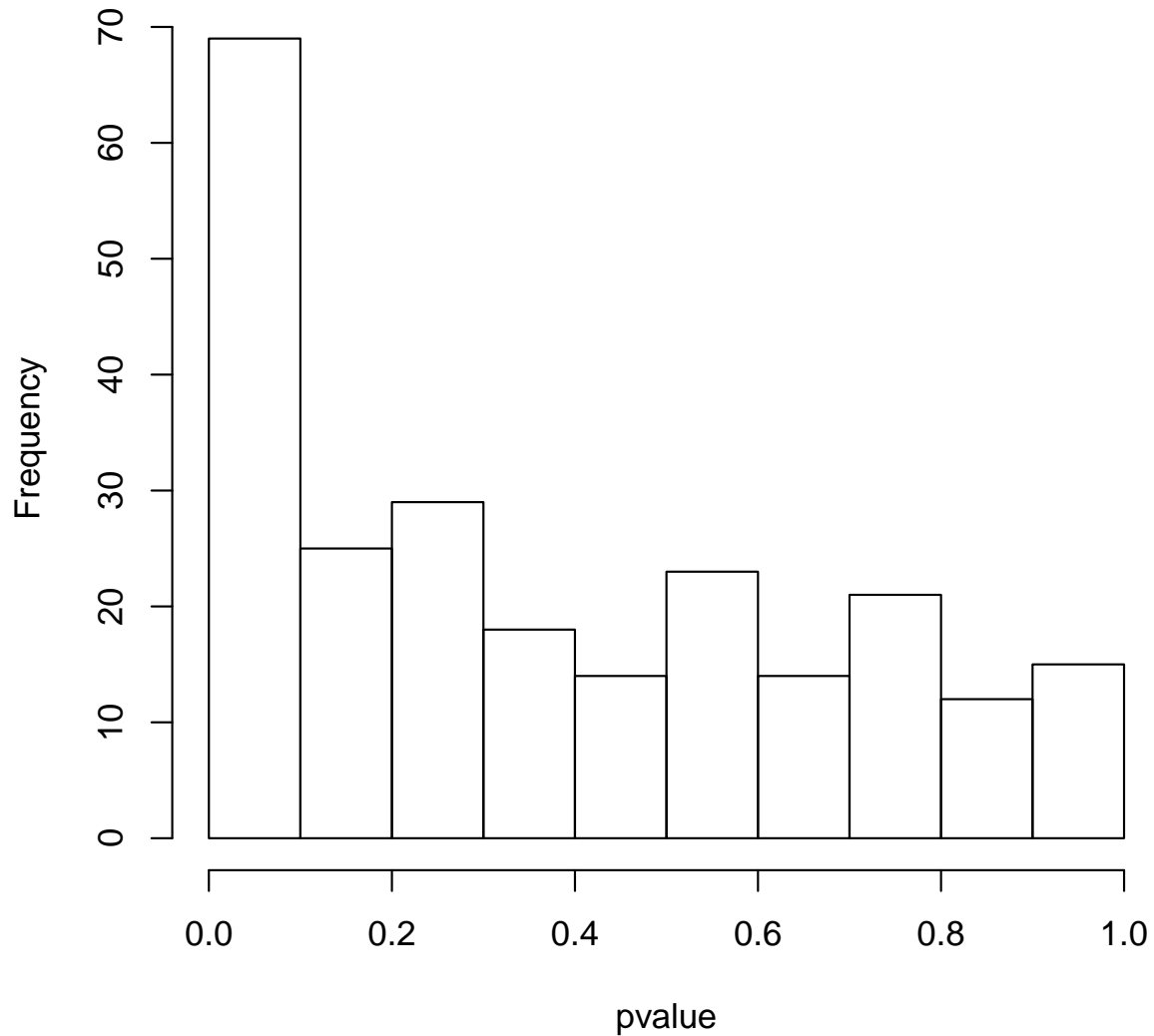
> system.time({DIRACan =GSReg.GeneSets.DIRAC(exprsdata,diracpathways,phenotypes)})
   user  system elapsed 
0.540   0.049   0.604 

>
```

Here is the histogram of the DIRAC p-values:

```
> hist(DIRACan$pvalues,xlab="pvalue",main="Hist of pvalues applying DIRAC Analysis.")
```

Hist of pvalues applying DIRAC Analysis.



To check if the approximations are reliable, we plot the z-scores calculated to approximate p-values versus the p-values from the permutation tests.

Figure 2 shows the result of comparing p-value DIRAC computing from 1000 permutation test and approximation using normal approximation (offline generated).

3.2 EVA

The package also implements the alternative EVA statistic in the function `GSReg.GeneSets.EVA`. The function requires the similar inputs as `GSReg.GeneSets.DIRAC` (i.e. `geneexpres`, `path-`

```

> plot(x=abs(DIRACAn$zscores),y=DIRACperm$pvalues,xlab="|Z-score|",
      ylab="p-value",col="red1",main="DIRAC p-value comparisons")
> zscorelin <- seq(min(abs(DIRACAn$zscores)),max(abs(DIRACAn$zscores)),by = 0.1)
> pvaltheoretic = (1-pnorm(zscorelin))*2
> lines(x=zscorelin,y=pvaltheoretic,type="l",pch=50,lty=5,col="darkblue")
> legend("topright",legend=c("permutation test","Normal Approx."),
      col=c("red1","blue"),text.col=c("red1","blue"),
      lty=c(NA,1),lwd=c(NA,2.5),pch=c(21,NA))

```

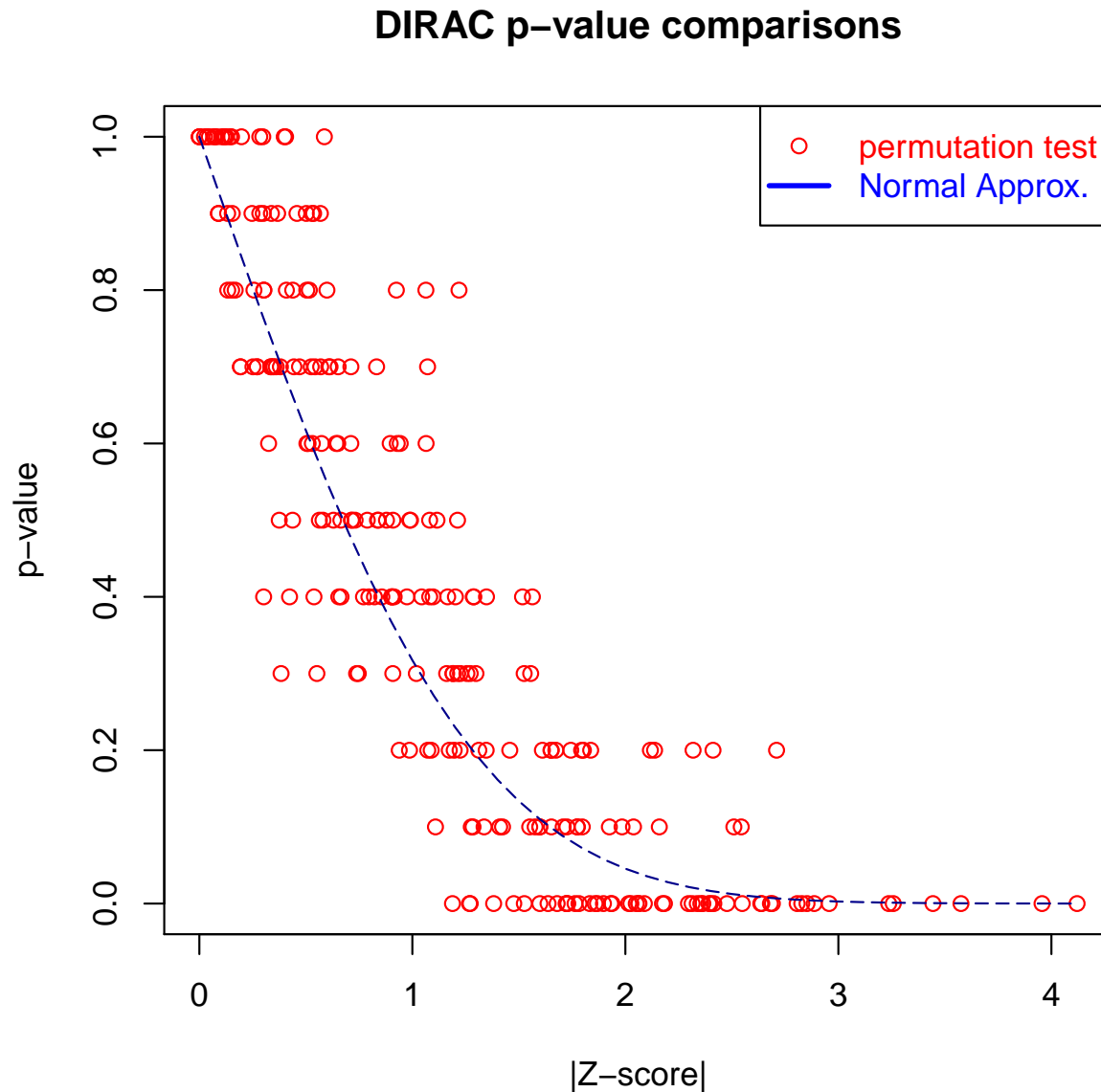


Figure 1: Comparing p-value from permutation test and normal approximation with only 10 permutations.

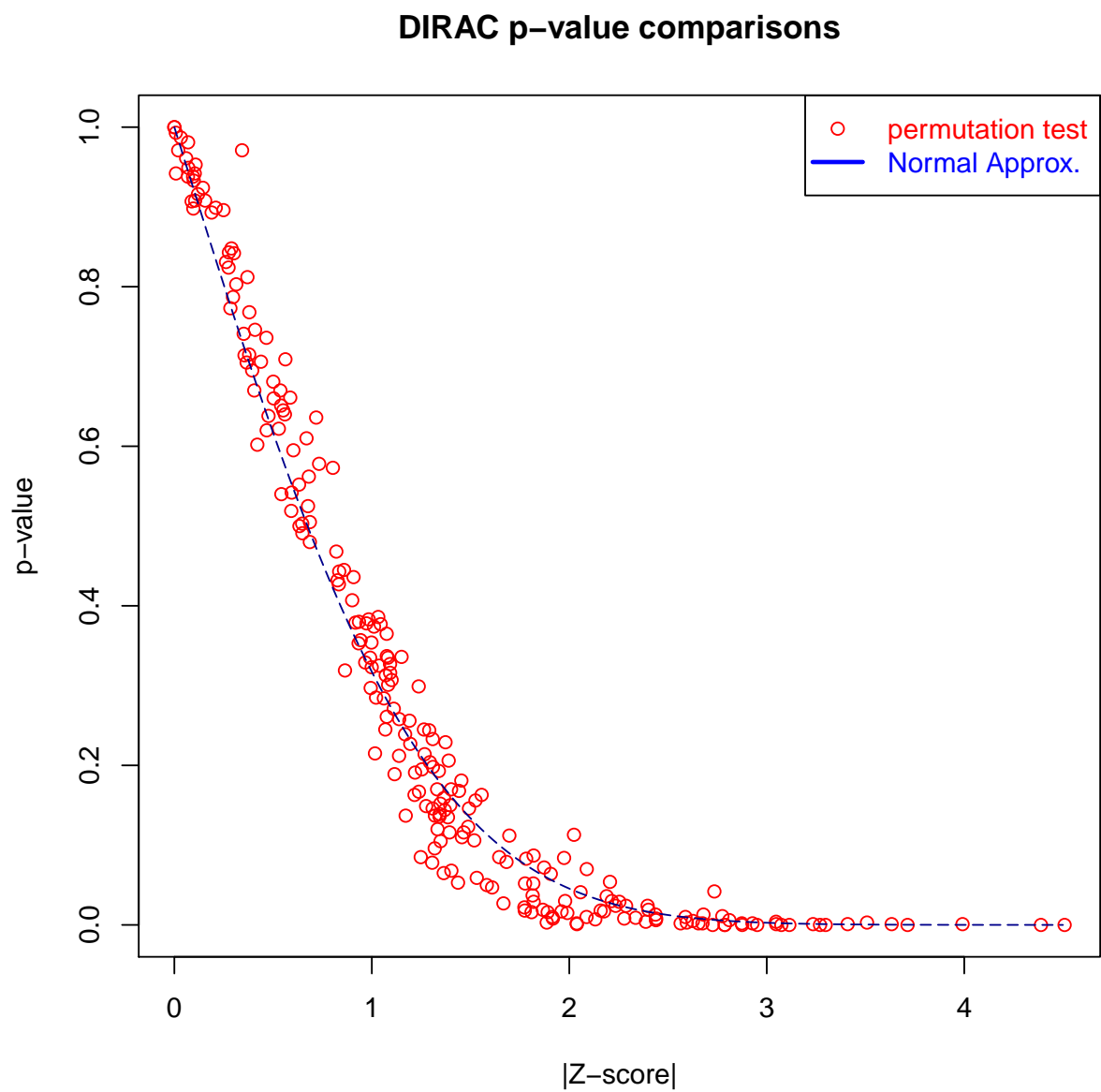


Figure 2: Theoretical p-value versus empirical p-value using 1000 permutations.

ways, phenotypes) except it does not need Nperm since the p-value is not calculated through permutation test but through the mentioned U-statistic theory approach.

```
> #Calculating the variance for the pathways
> #Calculate how much it takes to calculate the statistics and their p-value for all pathways
>
> system.time({VarAnKendallV = GSReg.GeneSets.EVA(geneexpres=exprsdata,
  pathways=diracpathways, phenotypes=as.factor(phenotypes)) })
  user  system elapsed
1.031   0.039   1.099

> names(VarAnKendallV)[[1]]

[1] "DEATHPATHWAY"

> VarAnKendallV[[1]]

$E1
[1] 0.09441352

$E2
[1] 0.1310383

$E12
[1] 0.1187962

$zscore
[1] -3.711215

$zscoreD12D1
[1] 3.693266

$zscoreD12D2
[1] -4.005794

$VarEta1
[1] 3.480369e-05

$VarEta2
[1] 6.248694e-05

$sdtotal
[1] 0.009863601

$CovD12D12p
[1] 3.345665e-05

$CovD12D1p2
[1] 0.0006611348

$CovD1D12
```

```

[1] 0.0001258984

$CovD1D12
[1] 0.0001258984

$vartotD12D1
[1] 4.34854e-05

$vartotD12D2
[1] 9.239714e-06

$pvalue
[1] 0.0002062669

$pvalueD12D1
[1] 0.0002213919

$pvalueD12D2
[1] 6.180938e-05

$pvalueTotal
[1] 0.0001854281

$mysdttotal
[1] 0.01159303

```

The output consists of a list. Each element of the list corresponds to a pathway. The element itself is a list. *E1* and *E2* are two fields which contain the measure of variability for phenotype levels(phenotypes) [1] and levels(phenotypes) [2] respectively. Other list elements are *pvalue* and *zscore* which are calculated through the theory of U-statistics and indicate the statistical significance of the difference between *E1* and *E2*.

3.3 Comparison of DIRAC and EVA

We ran the following code to compare statistics from DIRAC and from EVA.

```

> Nperm = 10;
> VarAnPerm = vector(mode="list",length=Nperm)
> for( i in seq_len(Nperm))
{
  VarAnPerm[[i]] = GSReg.GeneSets.EVA(geneexpres=exprsdata, pathways=diracpathways,
                                     phenotypes=sample(phenotypes))
}
> pvaluesperm = vector(mode="numeric",length=length(VarAnPerm[[1]]))
> for( i in seq_along(VarAnPerm[[1]]))
{
  z = sapply(VarAnPerm,function(x) x[[i]]$E1 - x[[i]]$E2)

```

```

    pvaluesperm[i] = mean(abs(VarAnKendallV[[i]]$E1-VarAnKendallV[[i]]$E2)<abs(z))
  }
> zscore = sapply(VarAnKendallV,function(x) x$zscore);
> pvalustat = sapply(VarAnKendallV,function(x) x$pvalue);

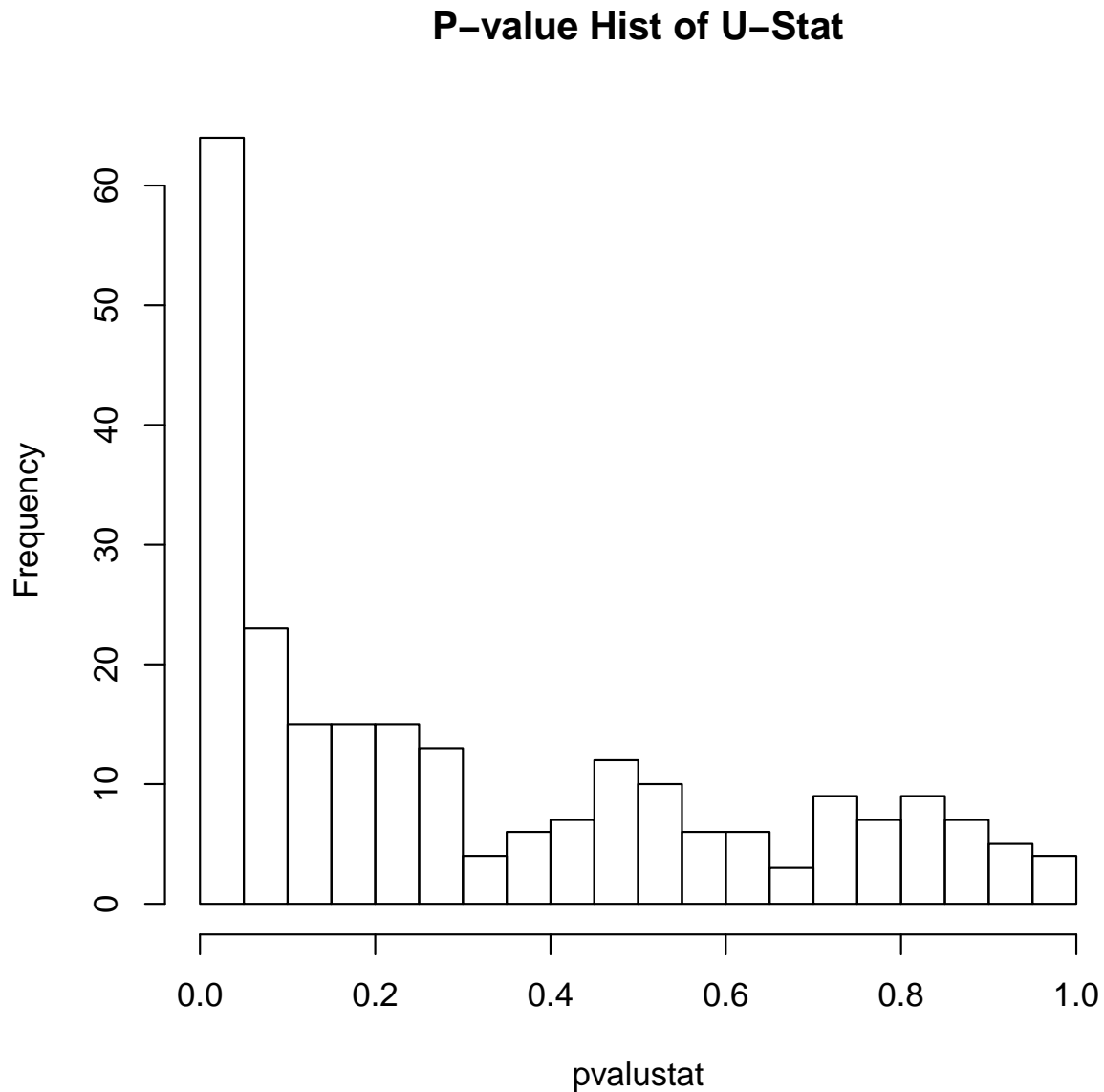
```

The figure represents that the theoretical p-value and p-value calculated from permutation test in EVA are very similar and we can use the theoretical p-value as a surrogate for p-value. Here is the histogram.

```

> hist(x=pvalustat,breaks=20,main="P-value Hist of U-Stat",xlim=c(0,1))

```



```

> plot(x=abs(zscore),y=pvaluesperm,xlab="|Z-score|",
      ylab="p-value",col="red1",main="p-value comparisons")
> zscorelin = seq(0,6,0.1);
> pvaltheoretic = (1-pnorm(zscorelin))*2
> lines(x=zscorelin,y=pvaltheoretic,type="l",pch=50,lty=5,col="darkblue")
> legend("topright",legend=c("permutation test","U-Stat Estimation"),
      col=c("red","blue"),text.col=c("red","blue"),
      lty=c(NA,1),lwd=c(NA,2.5),pch=c(21,NA))

```

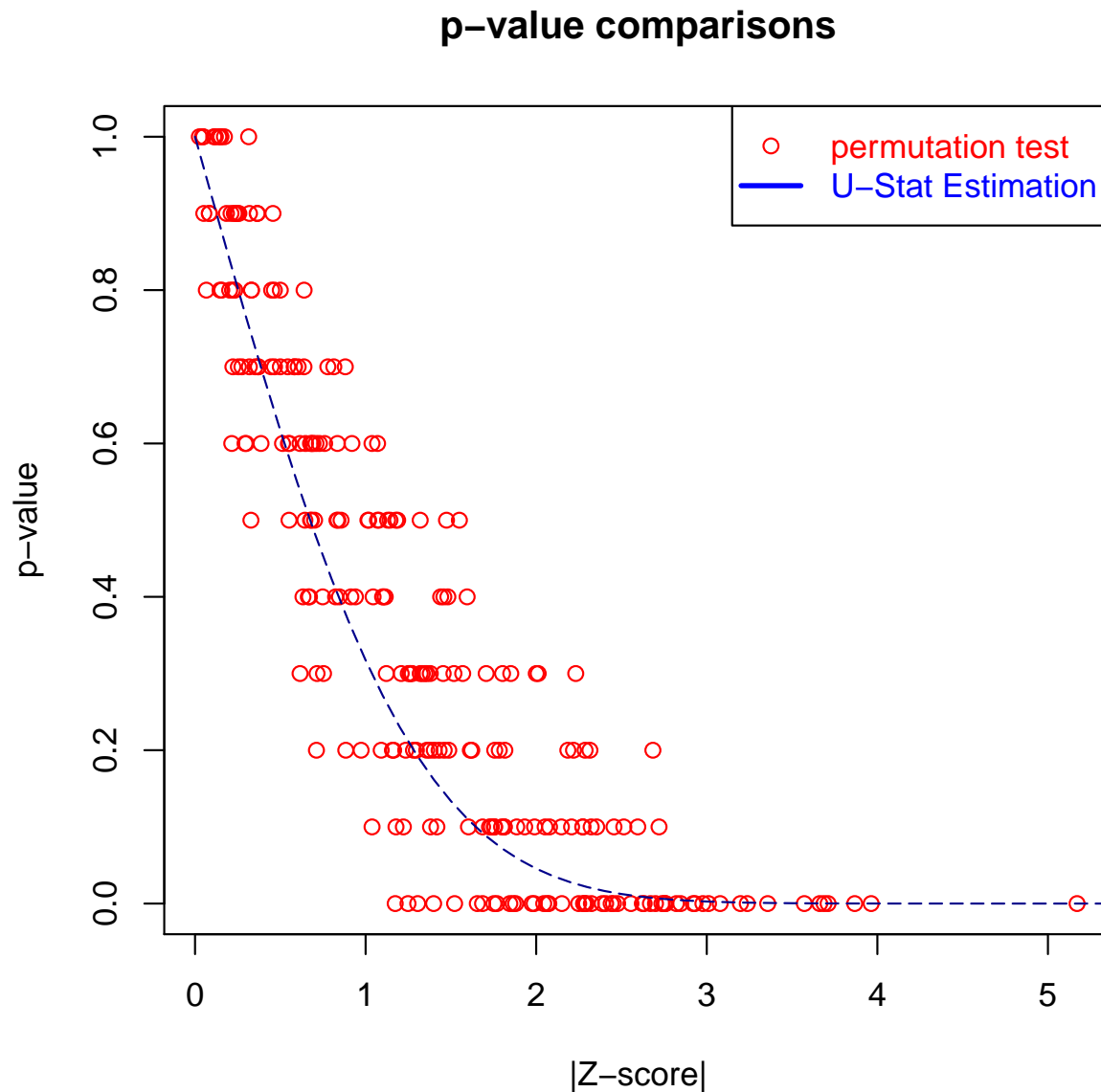


Figure 3: Comparing p-value from permutation test and U-statistic theory with only 10 permutations.

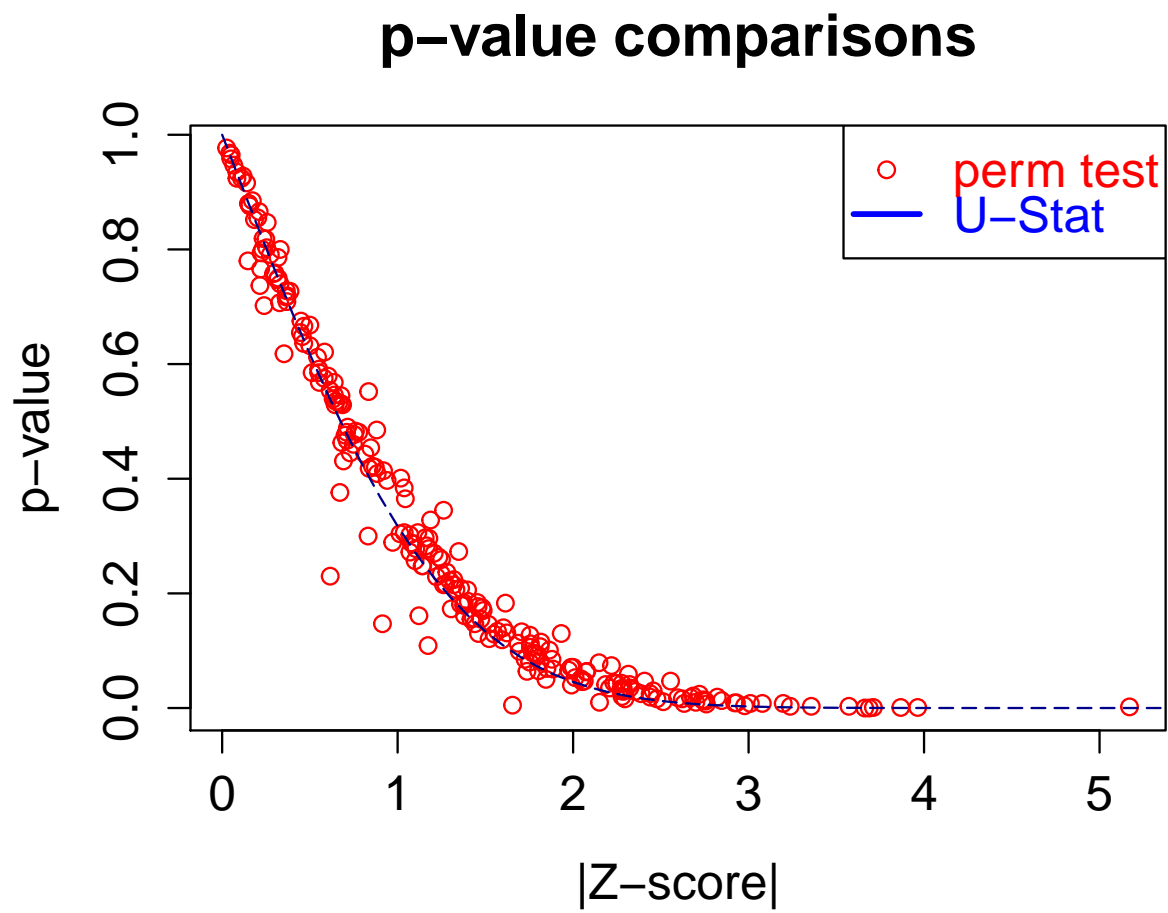


Figure 4: Theoretical p-value versus empirical p-value using 1000 permutations.

Figure 4 shows the result of comparing p-value EVA computing from 1000 permutation test and approximation using U-statistics theory (offline generated).

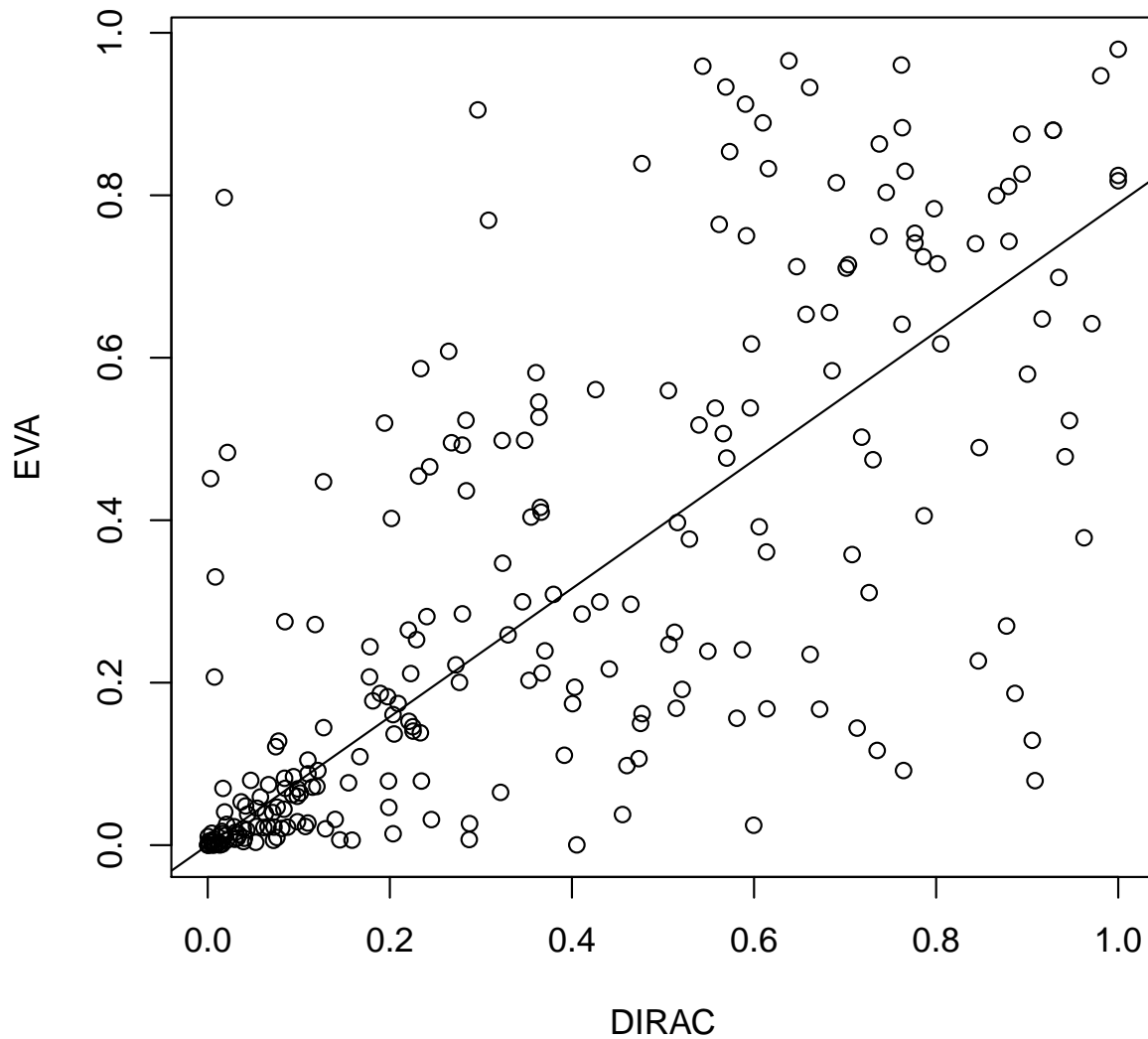
To compare with the p-value of the DIRAC analysis, we show the p-values of DIRAC versus U-Statistic methodology:

```
> plot(x=DIRACAn$pvalues,y=pvalustat,xlab ="DIRAC",
      ylab="EVA",main=sprintf("P-value Comparison corr=%2.2g",cor(x=DIRACAn$pvalues,y=pvalustat)))
> lmfit = lm(pvalustat~DIRACAn$pvalues-1)
> abline(lmfit)
> cor.test(x=DIRACAn$pvalues,y=pvalustat)

Pearson's product-moment correlation

data:  DIRACAn$pvalues and pvalustat
t = 15.834, df = 238, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.6484375 0.7727928
sample estimates:
      cor
0.7162546
```

P-value Comparison corr=0.72



Also, the correlation of the p-values of DIRAC and U-Statistics is very high:

```
> cor(x=DIRACan$pvalues,y=pvalustat)
[1] 0.7162546
```

If we use 1000 permutations instead of 10 permutations, we can see that the correlation is higher (0.88) as seen in Figure (5). The dysregulated pathways identified by *DIRAC* are the following pathways:

[1] "DEATHPATHWAY"	"NEUTROPHILPATHWAY"	"PGC1APATHWAY"
[4] "RARRXRPATHWAY"	"SKP2E2FPATHWAY"	"KERATINOCYTEPATHWAY"
[7] "CHEMICALPATHWAY"	"TGFBPATHWAY"	"PROTEASOMEPATHWAY"
[10] "MAPKPATHWAY"	"PDGFPATHWAY"	"BIOPEPTIDESPATHWAY"
[13] "SPPAPATHWAY"	"PYK2PATHWAY"	"MYOSINPATHWAY"
[16] "BETAOXIDATIONPATHWAY"	"IL7PATHWAY"	"FMLPPATHWAY"
[19] "VITCBPATHWAY"	"CD40PATHWAY"	"CDC25PATHWAY"
[22] "MTORPATHWAY"	"RNAPATHWAY"	"FBW7PATHWAY"
[25] "LYMPHOCYTEPATHWAY"	"LAIRPATHWAY"	"HIVNEFPATHWAY"
[28] "ALKPATHWAY"	"P35ALZHEIMERSPATHWAY"	"MSPPATHWAY"
[31] "GSK3PATHWAY"	"RELAPATHWAY"	"METPATHWAY"
[34] "TNFR2PATHWAY"	"AT1RPATHWAY"	"FREEPATHWAY"
[37] "ARAPPATHWAY"	"MRPPATHWAY"	"P53HYPOXIAPATHWAY"
[40] "IL18PATHWAY"	"STRESSPATHWAY"	"MEF2DPATHWAY"
[43] "STAT3PATHWAY"	"HSP27PATHWAY"	"EPONFKBPATHWAY"
[46] "NKCELLSPATHWAY"	"MONOCYTEPATHWAY"	"CARM_ERPATHWAY"

DIRAC and EVA have been shown mathematically similar. The main advantages of the EVA is efficiency in calculation as well as easier interpretation. Figure 5 a graphical example of such comparison. One can see that the p-values generated by DIRAC and EVA have high correlation, i.e. 0.88. Note that EVA is much faster than DIRAC. For example, in this case, we ran the computations on a Lenovo Thinkpad with Core(TM) i7-3720QM Intel CPU @2.6 GHz. For a thousand permutation, the DIRAC analysis took 207.47 seconds while the latter only took 0.3 seconds. Note that for multiple hypothesis adjustment, a thousand permutations may not be satisfactory and we require hundreds of thousand or a million permutation which may not be feasible.

Note that it is possible that some of the genes in a pathway are not represented in the expression data or are too short (e.g. less than 5 genes). Both `GSReg.GeneSets.EVA` and `GSReg.GeneSets.DIRAC` may ignore such pathways through parameter `minGeneNum`. Please see the manual for more details. If we the user wants to compare the results of DIRAC and

EVA, they can run the following code for plot DIRAC diagram of significantly perturbed pathways:

```
> DIRACAn =GSReg.GeneSets.DIRAC(exprsdata,diracpathways,phenotypes,Nperm=1000)

> significantPathwaysDIRAC = names(DIRACAn$mu1)[which(DIRACAn$pvalues<0.05)];
> mu1 = DIRACAn$mu1[significantPathwaysDIRAC];
> mu2 = DIRACAn$mu2[significantPathwaysDIRAC];
> #The dysregulated pathways
> names(mu1)

[1] "DEATHPATHWAY"      "NEUTROPHILPATHWAY"  "PGC1APATHWAY"
[4] "RARRXRPATHWAY"    "SKP2E2FPATHWAY"    "KERATINOCYTEPATHWAY"
[7] "CHEMICALPATHWAY"  "TGFBPATHWAY"       "PROTEASOMEPATHWAY"
```

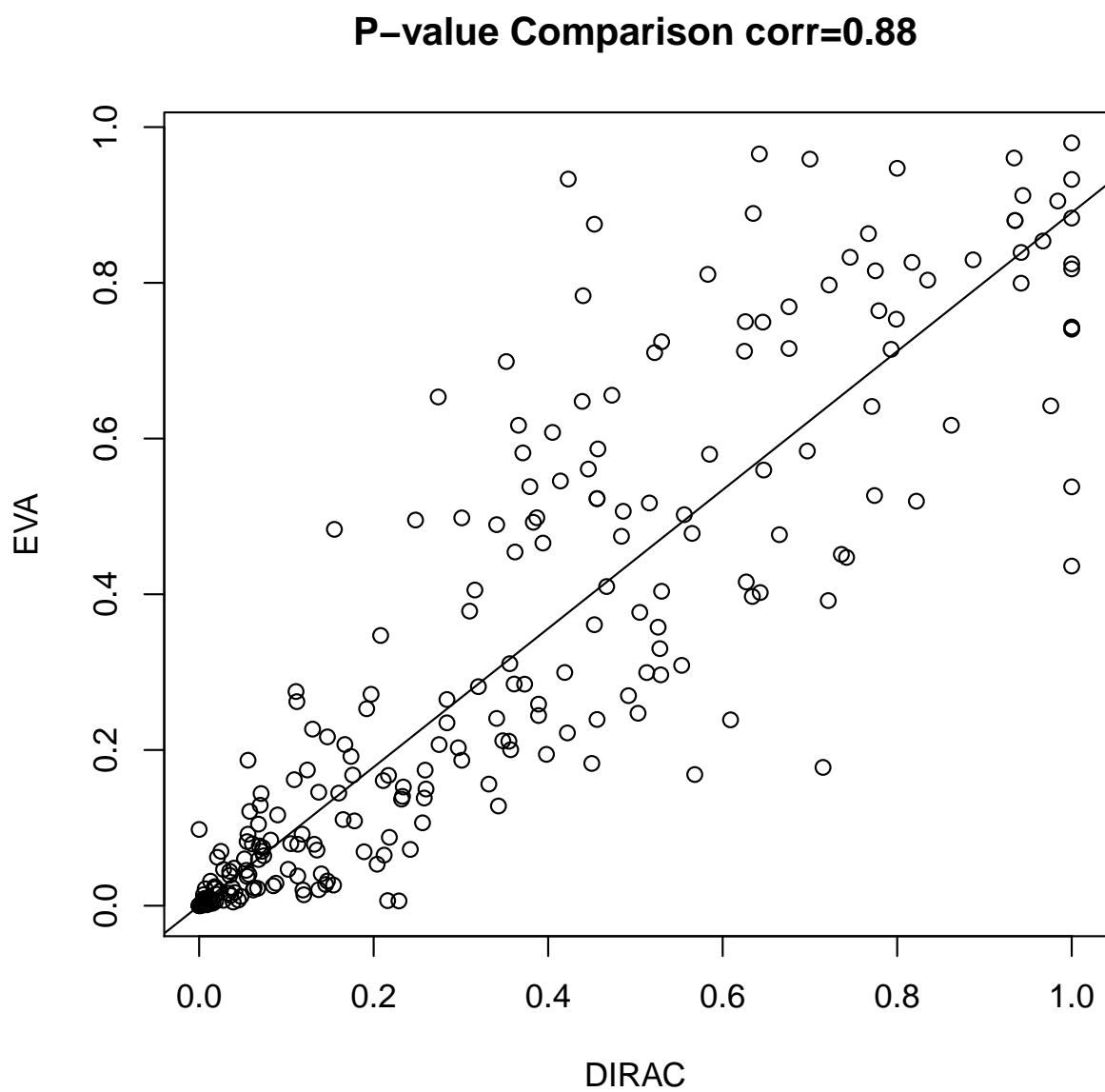



Figure 5: Comparing p-values EVA versus DIRAC. The correlation is 0.88.

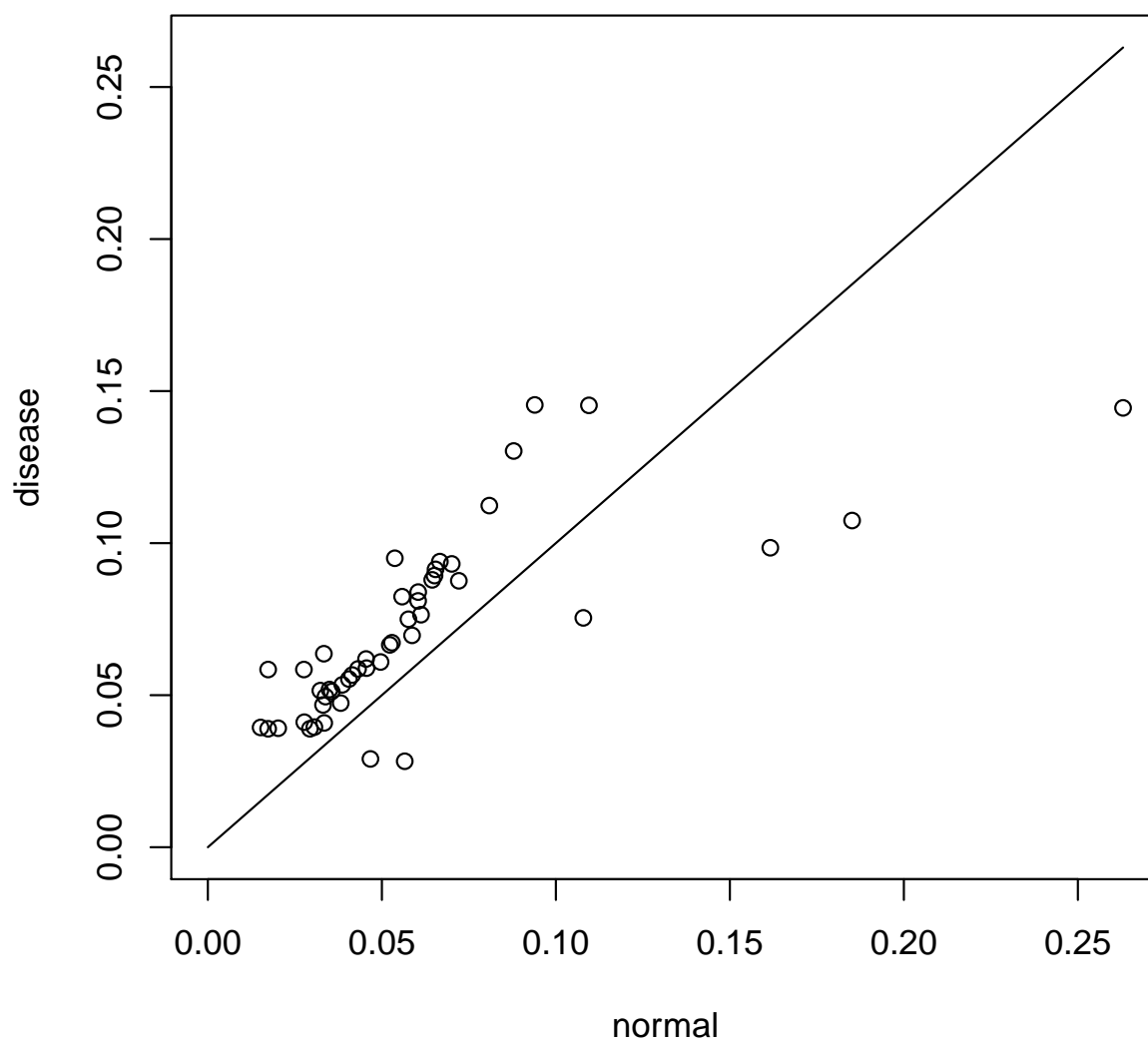
[10]	"MAPKPATHWAY"	"PDGFPATHWAY"	"BIOPEPTIDESPATWAY"
[13]	"SPPAPATHWAY"	"PYK2PATHWAY"	"MYOSINPATHWAY"
[16]	"BETAOXIDATIONPATHWAY"	"IL7PATHWAY"	"FMLPPATHWAY"
[19]	"VITCBPATHWAY"	"CD40PATHWAY"	"CDC25PATHWAY"
[22]	"MTORPATHWAY"	"RNAPATHWAY"	"FBW7PATHWAY"
[25]	"LYMPHOCYTEPATHWAY"	"LAIRPATHWAY"	"HIVNEFPATHWAY"
[28]	"ALKPATHWAY"	"P35ALZHEIMERSPATHWAY"	"MSPPATHWAY"
[31]	"GSK3PATHWAY"	"RELAPATHWAY"	"METPATHWAY"
[34]	"TNFR2PATHWAY"	"AT1RPATHWAY"	"FREEPATHWAY"
[37]	"ARAPPATHWAY"	"MRPPATHWAY"	"P53HYPOXIAPATHWAY"
[40]	"IL18PATHWAY"	"STRESSPATHWAY"	"MEF2DPATHWAY"
[43]	"STAT3PATHWAY"	"HSP27PATHWAY"	"EPONFKBPATHWAY"
[46]	"NKCELLSPATHWAY"	"MONOCYTEPATHWAY"	"CARM_ERPATHWAY"

```

> plot(x=mu1,y=mu2,
      xlim=c(0,max(mu1,mu2)),ylim=c(0,max(mu1,mu2)),xlab="normal",ylab="disease",
      main="(a) DIRAC significantly dysregulated pathways")
> lines(x=c(0,max(mu1,mu2)),y=c(0,max(mu1,mu2)))

```

(a) DIRAC significantly dysregulated pathways



Now, if we do the analysis using EVA, we have:

```
> significantPathwaysGSV = names(which(pvalustat<0.05));
```

[1] "DEATHPATHWAY"	"TCAPOPTOSISPATHWAY"	"NEUTROPHILPATHWAY"
[4] "PGC1APATHWAY"	"TERCPATHWAY"	"RARRXRPATHWAY"
[7] "SKP2E2FPATHWAY"	"KERATINOCYTEPATHWAY"	"CHEMICALPATHWAY"
[10] "METHIONINEPATHWAY"	"TGFBPATHWAY"	"PS1PATHWAY"
[13] "PROTEASOMEPATHWAY"	"CDK5PATHWAY"	"MAPKPATHWAY"
[16] "NTHIPATHWAY"	"PDGFPATHWAY"	"BIOPEPTIDEPATHWAY"
[19] "SPPAPATHWAY"	"PYK2PATHWAY"	"CDC42RACPATHWAY"

```

[22] "MYOSINPATHWAY"      "BETAOXIDATIONPATHWAY" "IL7PATHWAY"
[25] "FMLPPATHWAY"        "FASPATHWAY"           "VITCBPATHWAY"
[28] "CD40PATHWAY"        "IGF1PATHWAY"          "CDC25PATHWAY"
[31] "MTORPATHWAY"        "RNAPATHWAY"           "FBW7PATHWAY"
[34] "LYMPHOCYTEPATHWAY"  "LAIRPATHWAY"          "HIVNEFPATHWAY"
[37] "ALKPATHWAY"         "PEPIPATHWAY"          "MSPPATHWAY"
[40] "EDG1PATHWAY"        "GSK3PATHWAY"          "RELAPATHWAY"
[43] "METPATHWAY"         "TNFR2PATHWAY"         "AT1RPATHWAY"
[46] "ATRBRCPATHWAY"     "GLYCOLYSISPATHWAY"    "TIDPATHWAY"
[49] "EPOPATHWAY"         "WNTPATHWAY"           "ARAPPATHWAY"
[52] "MRPPATHWAY"         "P53HYPOXIAPATHWAY"    "PITX2PATHWAY"
[55] "IL18PATHWAY"        "STRESSPATHWAY"        "MEF2DPATHWAY"
[58] "MITOCHONDRIAPATHWAY" "STAT3PATHWAY"         "EPONFKBPATHWAY"
[61] "NKCELLSPATHWAY"     "MONOCYTEPATHWAY"      "CARM_ERPATHWAY"
[64] "HCMVPATHWAY"

```

```
> eta1 = sapply(VarAnKendallV,function(x) x$E1)[significantPathwaysGSV];
```

DEATHPATHWAY	TCAPOPTOSISPATHWAY	NEUTROPHILPATHWAY	PGC1APATHWAY
0.09441352	0.08600289	0.35559678	0.04477053
TERCPATHWAY	RARRXRPATHWAY	SKP2E2FPATHWAY	KERATINOCYTEPATHWAY
0.07316017	0.06914038	0.03367003	0.07404055
CHEMICALPATHWAY	METHIONINEPATHWAY	TGFBPATHWAY	PS1PATHWAY
0.08521303	0.09913420	0.05028305	0.08080808
PROTEASOMEPATHWAY	CDK5PATHWAY	MAPKPATHWAY	NTHIPATHWAY
0.09617180	0.07975863	0.08504987	0.08091115
PDGFPATHWAY	BIOPEPTIDESPATHWAY	SPPAPATHWAY	PYK2PATHWAY
0.08698709	0.06767807	0.09690598	0.04711514
CDC42RACPATHWAY	MYOSINPATHWAY	BETAOXIDATIONPATHWAY	IL7PATHWAY
0.08948195	0.09005280	0.02683983	0.10609668
FMLPPATHWAY	FASPATHWAY	VITCBPATHWAY	CD40PATHWAY
0.05736961	0.08676830	0.07888408	0.05294705
IGF1PATHWAY	CDC25PATHWAY	MTORPATHWAY	RNAPATHWAY
0.09115972	0.06265031	0.04188827	0.03009689
FBW7PATHWAY	LYMPHOCYTEPATHWAY	LAIRPATHWAY	HIVNEFPATHWAY
0.03174603	0.22390572	0.15222872	0.09020600
ALKPATHWAY	PEPIPATHWAY	MSPPATHWAY	EDG1PATHWAY
0.09130361	0.05194805	0.12150072	0.08801738
GSK3PATHWAY	RELAPATHWAY	METPATHWAY	TNFR2PATHWAY
0.11946928	0.06302309	0.10561315	0.05051566
AT1RPATHWAY	ATRBRCPATHWAY	GLYCOLYSISPATHWAY	TIDPATHWAY
0.05943314	0.07166907	0.02308802	0.07331013
EPOPATHWAY	WNTPATHWAY	ARAPPATHWAY	MRPPATHWAY
0.07319696	0.10526414	0.05988456	0.04877345
P53HYPOXIAPATHWAY	PITX2PATHWAY	IL18PATHWAY	STRESSPATHWAY
0.07708666	0.09375387	0.13015873	0.05505364
MEF2DPATHWAY	MITOCHONDRIAPATHWAY	STAT3PATHWAY	EPONFKBPATHWAY
0.04399740	0.12572150	0.05179344	0.07910272
NKCELLSPATHWAY	MONOCYTEPATHWAY	CARM_ERPATHWAY	HCMVPATHWAY
0.07718643	0.25171192	0.06462137	0.07781385

```
> eta2 = sapply(VarAnKendallV,function(x) x$E2)[significantPathwaysGSV];
```

DEATHPATHWAY	TCAPOPTOSISPATHWAY	NEUTROPHILPATHWAY	PGC1APATHWAY
0.13103827	0.04531025	0.23546691	0.05588351
TERCPATHWAY	RARRXRPATHWAY	SKP2E2FPATHWAY	KERATINOCYTEPATHWAY
0.12770563	0.09090909	0.05856181	0.09013983
CHEMICALPATHWAY	METHIONINEPATHWAY	TGFBPATHWAY	PS1PATHWAY
0.11832612	0.15454545	0.07165057	0.12332852
PROTEASOMEPATHWAY	CDK5PATHWAY	MAPKPATHWAY	NTHIPATHWAY
0.13083213	0.10251869	0.10114801	0.09532055
PDGFPATHWAY	BIOPEPTIDESPATHWAY	SPPAPATHWAY	PYK2PATHWAY
0.11066711	0.08559859	0.12604711	0.06023958
CDC42RACPATHWAY	MYOSINPATHWAY	BETAOXIDATIONPATHWAY	IL7PATHWAY
0.11283954	0.11997526	0.06147186	0.13455988
FMLPPATHWAY	FASPATHWAY	VITCBPATHWAY	CD40PATHWAY
0.06840858	0.10725265	0.04252044	0.08041958
IGF1PATHWAY	CDC25PATHWAY	MTORPATHWAY	RNAPATHWAY
0.12087036	0.04413179	0.05994640	0.08719852
FBW7PATHWAY	LYMPHOCYTEPATHWAY	LAIRPATHWAY	HIVNEFPATHWAY
0.06307978	0.16065416	0.11574140	0.11884884
ALKPATHWAY	PEPIPATHWAY	MSPPATHWAY	EDG1PATHWAY
0.11181840	0.13593074	0.17344877	0.11010728
GSK3PATHWAY	RELAPATHWAY	METPATHWAY	TNFR2PATHWAY
0.16320909	0.08203463	0.12858234	0.07308378
AT1RPATHWAY	ATRBRCPATHWAY	GLYCOLYSISPATHWAY	TIDPATHWAY
0.08115533	0.08771185	0.05112348	0.09458733
EPOPATHWAY	WNTPATHWAY	ARAPPATHWAY	MRPPATHWAY
0.09569080	0.12762130	0.07615440	0.08571429
P53HYPOXIAPATHWAY	PITX2PATHWAY	IL18PATHWAY	STRESSPATHWAY
0.09759247	0.11618223	0.18989899	0.07523998
MEF2DPATHWAY	MITOCHONDRIAPATHWAY	STAT3PATHWAY	EPONFKBPATHWAY
0.05508870	0.16778499	0.09647495	0.13372688
NKCELLSPATHWAY	MONOCYTEPATHWAY	CARM_ERPATHWAY	HCMVPATHWAY
0.09574739	0.17662338	0.08397641	0.08899711

> #The dysregulated pathways
> names(etal)

```

[1] "DEATHPATHWAY"      "TCAPOPTOSISPATHWAY" "NEUTROPHILPATHWAY"
[4] "PGC1APATHWAY"      "TERCPATHWAY"        "RARRXRPATHWAY"
[7] "SKP2E2FPATHWAY"    "KERATINOCYTEPATHWAY" "CHEMICALPATHWAY"
[10] "METHIONINEPATHWAY" "TGFBPATHWAY"        "PS1PATHWAY"
[13] "PROTEASOMEPATHWAY" "CDK5PATHWAY"        "MAPKPATHWAY"
[16] "NTHIPATHWAY"       "PDGFPATHWAY"        "BIOPEPTIDESPATHWAY"
[19] "SPPAPATHWAY"       "PYK2PATHWAY"        "CDC42RACPATHWAY"
[22] "MYOSINPATHWAY"     "BETAOXIDATIONPATHWAY" "IL7PATHWAY"
[25] "FMLPPATHWAY"       "FASPATHWAY"         "VITCBPATHWAY"
[28] "CD40PATHWAY"       "IGF1PATHWAY"        "CDC25PATHWAY"
[31] "MTORPATHWAY"       "RNAPATHWAY"         "FBW7PATHWAY"
[34] "LYMPHOCYTEPATHWAY" "LAIRPATHWAY"        "HIVNEFPATHWAY"
[37] "ALKPATHWAY"        "PEPIPATHWAY"        "MSPPATHWAY"
[40] "EDG1PATHWAY"       "GSK3PATHWAY"        "RELAPATHWAY"
[43] "METPATHWAY"        "TNFR2PATHWAY"       "AT1RPATHWAY"
[46] "ATRBRCPATHWAY"     "GLYCOLYSISPATHWAY"  "TIDPATHWAY"

```

```

[49] "EPOPATHWAY"          "WNTPATHWAY"          "ARAPPATHWAY"
[52] "MRPPATHWAY"          "P53HYPOXIAPATHWAY"   "PITX2PATHWAY"
[55] "IL18PATHWAY"         "STRESSPATHWAY"       "MEF2DPATHWAY"
[58] "MITOCHONDRIAPATHWAY" "STAT3PATHWAY"        "EPONFKBPATHWAY"
[61] "NKCELLSPATHWAY"      "MONOCYTEPATHWAY"     "CARM_ERPATHWAY"
[64] "HCMVPATHWAY"

> plot(x=eta1,y=eta2,xlim=c(0,max(eta1,eta2)),ylim=c(0,max(eta1,eta2)),xlab="normal",ylab="disease",
      main="(b) EVA: Dysregulated pathways")

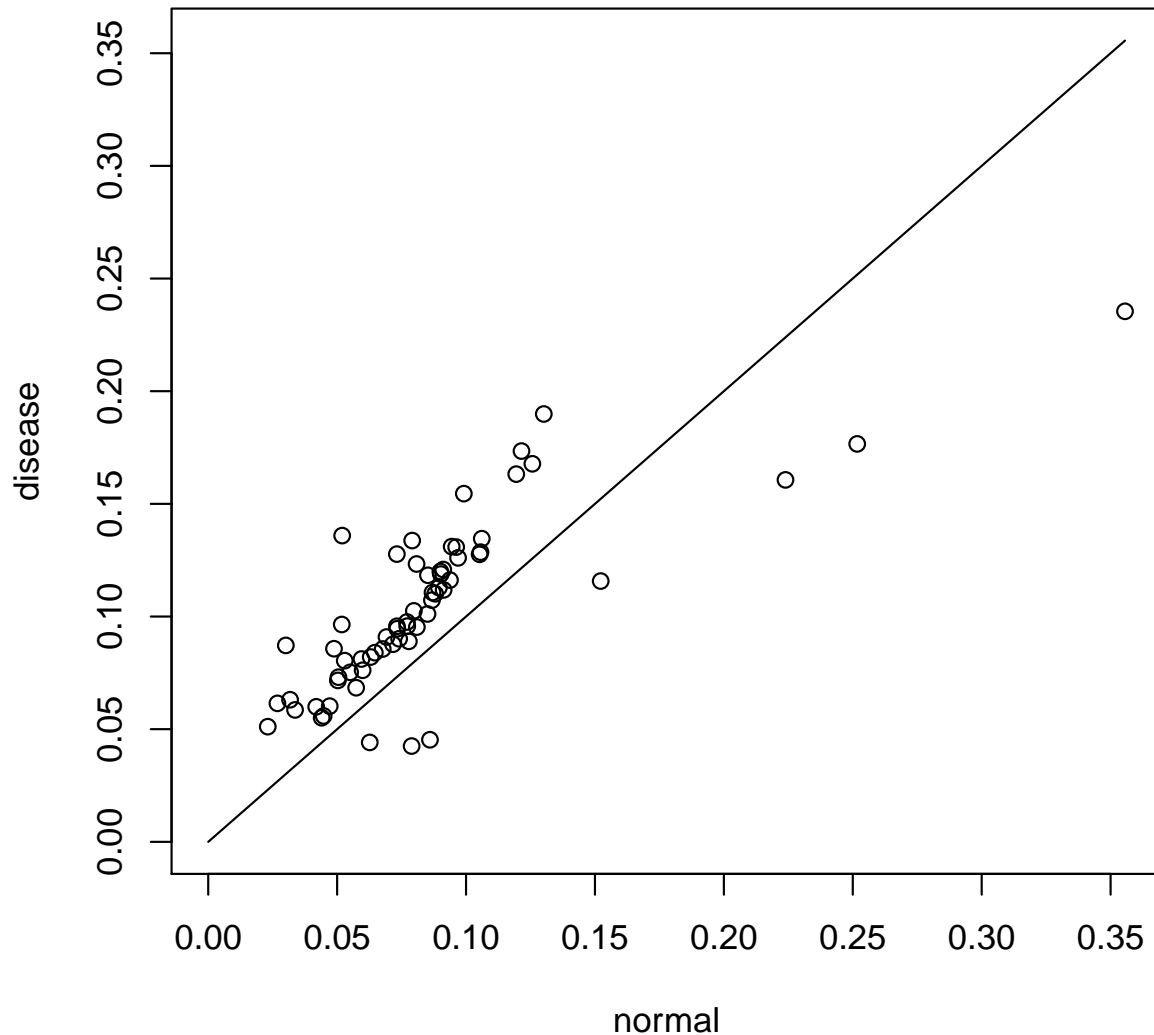
NULL

> lines(x=c(0,max(eta1,eta2)),y=c(0,max(eta1,eta2)))

NULL

```

(b) EVA: Dysregulated pathways



Although there is discrepancy in identified dysregulated pathways ($p\text{-value} < 0.05$), the general trend found in [1] holds still true. The trend is that usually the dysregulated pathways have higher variability measure in more dangerous phenotypes. The figures reveal that both DIRAC and EVA have this property. DIRAC found 48 dysregulated pathways and EVA discovered 64 pathways, 45 pathways showed up in both analysis, and 67 pathways were discovered totally.

```
> print(significantPathwaysGSV)
```

```

[1] "DEATHPATHWAY"          "TCAPOPTOSISPATHWAY"  "NEUTROPHILPATHWAY"
[4] "PGC1APATHWAY"          "TERCPATHWAY"          "RARRXRPATHWAY"
[7] "SKP2E2FPATHWAY"        "KERATINOCYTEPATHWAY" "CHEMICALPATHWAY"
[10] "METHIONINEPATHWAY"     "TGFBPATHWAY"          "PS1PATHWAY"
[13] "PROTEASOMEPATHWAY"     "CDK5PATHWAY"          "MAPKPATHWAY"
[16] "NTHIPATHWAY"           "PDGFPATHWAY"          "BIOPEPTIDESPATHWAY"
[19] "SPPAPATHWAY"           "PYK2PATHWAY"          "CDC42RACPATHWAY"
[22] "MYOSINPATHWAY"         "BETAOXIDATIONPATHWAY" "IL7PATHWAY"
[25] "FMLPPATHWAY"           "FASPATHWAY"           "VITCBPATHWAY"
[28] "CD40PATHWAY"           "IGF1PATHWAY"          "CDC25PATHWAY"
[31] "MTORPATHWAY"           "RNAPATHWAY"           "FBW7PATHWAY"
[34] "LYMPHOCYTEPATHWAY"     "LAIRPATHWAY"          "HIVNEFPATHWAY"
[37] "ALKPATHWAY"            "PEPIPATHWAY"          "MSPPATHWAY"
[40] "EDG1PATHWAY"           "GSK3PATHWAY"          "RELAPATHWAY"
[43] "METPATHWAY"            "TNFR2PATHWAY"         "AT1RPATHWAY"
[46] "ATRBRCAPATHWAY"        "GLYCOLYSISPATHWAY"    "TIDPATHWAY"
[49] "EOPATHWAY"             "WNTPATHWAY"           "ARAPPATHWAY"
[52] "MRPPATHWAY"            "P53HYPOXIAPATHWAY"    "PITX2PATHWAY"
[55] "IL18PATHWAY"           "STRESSPATHWAY"        "MEF2DPATHWAY"
[58] "MITOCHONDRIAPATHWAY"   "STAT3PATHWAY"         "EPONFKBPATHWAY"
[61] "NKCELLSPATHWAY"        "MONOCYTEPATHWAY"      "CARM_ERPATHWAY"
[64] "HCMVPATHWAY"

[1] "DEATHPATHWAY"          "TCAPOPTOSISPATHWAY"  "NEUTROPHILPATHWAY"
[4] "PGC1APATHWAY"          "TERCPATHWAY"          "RARRXRPATHWAY"
[7] "SKP2E2FPATHWAY"        "KERATINOCYTEPATHWAY" "CHEMICALPATHWAY"
[10] "METHIONINEPATHWAY"     "TGFBPATHWAY"          "PS1PATHWAY"
[13] "PROTEASOMEPATHWAY"     "CDK5PATHWAY"          "MAPKPATHWAY"
[16] "NTHIPATHWAY"           "PDGFPATHWAY"          "BIOPEPTIDESPATHWAY"
[19] "SPPAPATHWAY"           "PYK2PATHWAY"          "CDC42RACPATHWAY"
[22] "MYOSINPATHWAY"         "BETAOXIDATIONPATHWAY" "IL7PATHWAY"
[25] "FMLPPATHWAY"           "FASPATHWAY"           "VITCBPATHWAY"
[28] "CD40PATHWAY"           "IGF1PATHWAY"          "CDC25PATHWAY"
[31] "MTORPATHWAY"           "RNAPATHWAY"           "FBW7PATHWAY"
[34] "LYMPHOCYTEPATHWAY"     "LAIRPATHWAY"          "HIVNEFPATHWAY"
[37] "ALKPATHWAY"            "PEPIPATHWAY"          "MSPPATHWAY"
[40] "EDG1PATHWAY"           "GSK3PATHWAY"          "RELAPATHWAY"
[43] "METPATHWAY"            "TNFR2PATHWAY"         "AT1RPATHWAY"
[46] "ATRBRCAPATHWAY"        "GLYCOLYSISPATHWAY"    "TIDPATHWAY"
[49] "EOPATHWAY"             "WNTPATHWAY"           "ARAPPATHWAY"
[52] "MRPPATHWAY"            "P53HYPOXIAPATHWAY"    "PITX2PATHWAY"
[55] "IL18PATHWAY"           "STRESSPATHWAY"        "MEF2DPATHWAY"
[58] "MITOCHONDRIAPATHWAY"   "STAT3PATHWAY"         "EPONFKBPATHWAY"
[61] "NKCELLSPATHWAY"        "MONOCYTEPATHWAY"      "CARM_ERPATHWAY"
[64] "HCMVPATHWAY"

```

```
> print(significantPathwaysDIRAC)
```

```

[1] "DEATHPATHWAY"          "NEUTROPHILPATHWAY"    "PGC1APATHWAY"
[4] "RARRXRPATHWAY"         "SKP2E2FPATHWAY"       "KERATINOCYTEPATHWAY"
[7] "CHEMICALPATHWAY"       "TGFBPATHWAY"          "PROTEASOMEPATHWAY"
[10] "MAPKPATHWAY"           "PDGFPATHWAY"          "BIOPEPTIDESPATHWAY"
[13] "SPPAPATHWAY"           "PYK2PATHWAY"          "MYOSINPATHWAY"

```


[16]	"BETAOXIDATIONPATHWAY"	"IL7PATHWAY"	"FMLPPATHWAY"
[19]	"VITCBPATHWAY"	"CD40PATHWAY"	"CDC25PATHWAY"
[22]	"MTORPATHWAY"	"RNAPATHWAY"	"FBW7PATHWAY"
[25]	"LYMPHOCYTEPATHWAY"	"LAIRPATHWAY"	"HIVNEFPATHWAY"
[28]	"ALKPATHWAY"	"P35ALZHEIMERSPATHWAY"	"MSPPATHWAY"
[31]	"GSK3PATHWAY"	"RELAPATHWAY"	"METPATHWAY"
[34]	"TNFR2PATHWAY"	"AT1RPATHWAY"	"FREEPATHWAY"
[37]	"ARAPPATHWAY"	"MRPPATHWAY"	"P53HYPOXIAPATHWAY"
[40]	"IL18PATHWAY"	"STRESSPATHWAY"	"MEF2DPATHWAY"
[43]	"STAT3PATHWAY"	"HSP27PATHWAY"	"EPONFKBPATHWAY"
[46]	"NKCELLSPATHWAY"	"MONOCYTEPATHWAY"	"CARM_ERPATHWAY"
[1]	"DEATHPATHWAY"	"NEUTROPHILPATHWAY"	"PGC1APATHWAY"
[4]	"RARRXRPATHWAY"	"SKP2E2FPATHWAY"	"KERATINOCYTEPATHWAY"
[7]	"CHEMICALPATHWAY"	"TGFBPATHWAY"	"PROTEASOMEPATHWAY"
[10]	"MAPKPATHWAY"	"PDGFPATHWAY"	"BIOPEPTIDESPATHWAY"
[13]	"SPPAPATHWAY"	"PYK2PATHWAY"	"MYOSINPATHWAY"
[16]	"BETAOXIDATIONPATHWAY"	"IL7PATHWAY"	"FMLPPATHWAY"
[19]	"VITCBPATHWAY"	"CD40PATHWAY"	"CDC25PATHWAY"
[22]	"MTORPATHWAY"	"RNAPATHWAY"	"FBW7PATHWAY"
[25]	"LYMPHOCYTEPATHWAY"	"LAIRPATHWAY"	"HIVNEFPATHWAY"
[28]	"ALKPATHWAY"	"P35ALZHEIMERSPATHWAY"	"MSPPATHWAY"
[31]	"GSK3PATHWAY"	"RELAPATHWAY"	"METPATHWAY"
[34]	"TNFR2PATHWAY"	"AT1RPATHWAY"	"FREEPATHWAY"
[37]	"ARAPPATHWAY"	"MRPPATHWAY"	"P53HYPOXIAPATHWAY"
[40]	"IL18PATHWAY"	"STRESSPATHWAY"	"MEF2DPATHWAY"
[43]	"STAT3PATHWAY"	"HSP27PATHWAY"	"EPONFKBPATHWAY"
[46]	"NKCELLSPATHWAY"	"MONOCYTEPATHWAY"	"CARM_ERPATHWAY"

3.4 Splice-EVA Analysis

SEVA needs junction overlap matrices. This can be done by function `GSReg.overlapJunction`. Here is a piece of code which shows how to use this function.

```
> require('Homo.sapiens')
[1] TRUE

> require('org.Hs.eg.db')
[1] TRUE

> require('GenomicRanges')
[1] TRUE

> data(juncExprsSimulated)
[1] "juncExprsSimulated"

> overlapMat <- GSReg.overlapJunction(juncExprs = junc.RPM.Simulated,
                                     geneexpr = geneExprsGSReg)
```

\$Rest

\$Rest\$CMPK1

	chr1:47799788-47834141	chr1:47834287-47838627
chr1:47799788-47834141	1	0
chr1:47834287-47838627	0	1
chr1:47838779-47840581	0	0
chr1:47838779-47840869	0	0
chr1:47840657-47840869	0	0
chr1:47840965-47842376	0	0
	chr1:47838779-47840581	chr1:47838779-47840869
chr1:47799788-47834141	0	0
chr1:47834287-47838627	0	0
chr1:47838779-47840581	1	1
chr1:47838779-47840869	1	1
chr1:47840657-47840869	0	1
chr1:47840965-47842376	0	0
	chr1:47840657-47840869	chr1:47840965-47842376
chr1:47799788-47834141	0	0
chr1:47834287-47838627	0	0
chr1:47838779-47840581	0	0
chr1:47838779-47840869	1	0
chr1:47840657-47840869	1	0
chr1:47840965-47842376	0	1

\$Rest\$CSF1

	chr1:110453684-110456881	chr1:110457003-110458256
chr1:110453684-110456881	1	0
chr1:110457003-110458256	0	1
chr1:110458318-110459915	0	0
chr1:110460085-110464469	0	0
chr1:110464616-110465788	0	0
chr1:110464616-110466682	0	0
chr1:110466812-110467398	0	0
chr1:110467450-110467769	0	0
chr1:110467824-110468685	0	0
chr1:110467824-110471474	0	0
	chr1:110458318-110459915	chr1:110460085-110464469
chr1:110453684-110456881	0	0
chr1:110457003-110458256	0	0
chr1:110458318-110459915	1	0
chr1:110460085-110464469	0	1
chr1:110464616-110465788	0	0
chr1:110464616-110466682	0	0
chr1:110466812-110467398	0	0
chr1:110467450-110467769	0	0
chr1:110467824-110468685	0	0
chr1:110467824-110471474	0	0
	chr1:110464616-110465788	chr1:110464616-110466682
chr1:110453684-110456881	0	0
chr1:110457003-110458256	0	0
chr1:110458318-110459915	0	0

chr1:110460085-110464469	0	0
chr1:110464616-110465788	1	1
chr1:110464616-110466682	1	1
chr1:110466812-110467398	0	0
chr1:110467450-110467769	0	0
chr1:110467824-110468685	0	0
chr1:110467824-110471474	0	0
chr1:110466812-110467398 chr1:110467450-110467769		
chr1:110453684-110456881	0	0
chr1:110457003-110458256	0	0
chr1:110458318-110459915	0	0
chr1:110460085-110464469	0	0
chr1:110464616-110465788	0	0
chr1:110464616-110466682	0	0
chr1:110466812-110467398	1	0
chr1:110467450-110467769	0	1
chr1:110467824-110468685	0	0
chr1:110467824-110471474	0	0
chr1:110467824-110468685 chr1:110467824-110471474		
chr1:110453684-110456881	0	0
chr1:110457003-110458256	0	0
chr1:110458318-110459915	0	0
chr1:110460085-110464469	0	0
chr1:110464616-110465788	0	0
chr1:110464616-110466682	0	0
chr1:110466812-110467398	0	0
chr1:110467450-110467769	0	0
chr1:110467824-110468685	1	1
chr1:110467824-110471474	1	1
\$Rest\$FAM72B		
chr1:120839865-120841975 chr1:120839985-120841975		
chr1:120839865-120841975	1	1
chr1:120839985-120841975	1	1
chr1:120842052-120845995	0	0
chr1:120846119-120854492	0	0
chr1:120842052-120845995 chr1:120846119-120854492		
chr1:120839865-120841975	0	0
chr1:120839985-120841975	0	0
chr1:120842052-120845995	1	0
chr1:120846119-120854492	0	1
\$Rest\$KLHL12		
chr1:202861787-202862367 chr1:202861787-202863312		
chr1:202861787-202862367	1	1
chr1:202861787-202863312	1	1
chr1:202862553-202863312	0	1
chr1:202863410-202863719	0	0
chr1:202863877-202864650	0	0
chr1:202863877-202878138	0	0
chr1:202864845-202865982	0	0

chr1:202866088-202878138	0	0
chr1:202878252-202880182	0	0
chr1:202880331-202887299	0	0
chr1:202887516-202888883	0	0
chr1:202889036-202894096	0	0
chr1:202894335-202896217	0	0
chr1:202862553-202863312	chr1:202863410-202863719	
chr1:202861787-202862367	0	0
chr1:202861787-202863312	1	0
chr1:202862553-202863312	1	0
chr1:202863410-202863719	0	1
chr1:202863877-202864650	0	0
chr1:202863877-202878138	0	0
chr1:202864845-202865982	0	0
chr1:202866088-202878138	0	0
chr1:202878252-202880182	0	0
chr1:202880331-202887299	0	0
chr1:202887516-202888883	0	0
chr1:202889036-202894096	0	0
chr1:202894335-202896217	0	0
chr1:202863877-202864650	chr1:202863877-202878138	
chr1:202861787-202862367	0	0
chr1:202861787-202863312	0	0
chr1:202862553-202863312	0	0
chr1:202863410-202863719	0	0
chr1:202863877-202864650	1	1
chr1:202863877-202878138	1	1
chr1:202864845-202865982	0	1
chr1:202866088-202878138	0	1
chr1:202878252-202880182	0	0
chr1:202880331-202887299	0	0
chr1:202887516-202888883	0	0
chr1:202889036-202894096	0	0
chr1:202894335-202896217	0	0
chr1:202864845-202865982	chr1:202866088-202878138	
chr1:202861787-202862367	0	0
chr1:202861787-202863312	0	0
chr1:202862553-202863312	0	0
chr1:202863410-202863719	0	0
chr1:202863877-202864650	0	0
chr1:202863877-202878138	1	1
chr1:202864845-202865982	1	0
chr1:202866088-202878138	0	1
chr1:202878252-202880182	0	0
chr1:202880331-202887299	0	0
chr1:202887516-202888883	0	0
chr1:202889036-202894096	0	0
chr1:202894335-202896217	0	0
chr1:202878252-202880182	chr1:202880331-202887299	
chr1:202861787-202862367	0	0
chr1:202861787-202863312	0	0

chr1:202862553-202863312	0	0
chr1:202863410-202863719	0	0
chr1:202863877-202864650	0	0
chr1:202863877-202878138	0	0
chr1:202864845-202865982	0	0
chr1:202866088-202878138	0	0
chr1:202878252-202880182	1	0
chr1:202880331-202887299	0	1
chr1:202887516-202888883	0	0
chr1:202889036-202894096	0	0
chr1:202894335-202896217	0	0
chr1:202887516-202888883 chr1:202889036-202894096		
chr1:202861787-202862367	0	0
chr1:202861787-202863312	0	0
chr1:202862553-202863312	0	0
chr1:202863410-202863719	0	0
chr1:202863877-202864650	0	0
chr1:202863877-202878138	0	0
chr1:202864845-202865982	0	0
chr1:202866088-202878138	0	0
chr1:202878252-202880182	0	0
chr1:202880331-202887299	0	0
chr1:202887516-202888883	1	0
chr1:202889036-202894096	0	1
chr1:202894335-202896217	0	0
chr1:202894335-202896217		
chr1:202861787-202862367	0	
chr1:202861787-202863312	0	
chr1:202862553-202863312	0	
chr1:202863410-202863719	0	
chr1:202863877-202864650	0	
chr1:202863877-202878138	0	
chr1:202864845-202865982	0	
chr1:202866088-202878138	0	
chr1:202878252-202880182	0	
chr1:202880331-202887299	0	
chr1:202887516-202888883	0	
chr1:202889036-202894096	0	
chr1:202894335-202896217	1	
\$Rest\$KLHL21		
chr1:6653718-6655545 chr1:6655617-6659107 chr1:6659512-6659810		
chr1:6653718-6655545	1	0
chr1:6655617-6659107	0	1
chr1:6659512-6659810	0	0
chr1:6659512-6661857	0	0
chr1:6659512-6661857		
chr1:6653718-6655545	0	
chr1:6655617-6659107	0	
chr1:6659512-6659810	1	
chr1:6659512-6661857	1	

\$Rest\$MIR4632

chr1:12251142-12251831

chr1:12251142-12251831 1

\$Rest\$MYSM1

chr1:59125827-59126842 chr1:59126899-59127078

chr1:59125827-59126842	1	0
chr1:59126899-59127078	0	1
chr1:59127183-59131171	0	0
chr1:59131303-59132710	0	0
chr1:59132898-59133519	0	0
chr1:59133593-59134102	0	0
chr1:59133593-59134304	0	0
chr1:59134238-59134656	0	0
chr1:59134354-59134656	0	0
chr1:59134710-59137542	0	0
chr1:59137630-59139245	0	0
chr1:59139322-59141149	0	0
chr1:59141252-59142598	0	0
chr1:59142728-59147457	0	0
chr1:59148217-59150825	0	0
chr1:59150923-59154710	0	0
chr1:59154788-59155898	0	0
chr1:59155921-59156012	0	0
chr1:59156089-59158533	0	0
chr1:59158603-59160801	0	0
chr1:59160879-59165657	0	0

chr1:59127183-59131171 chr1:59131303-59132710

chr1:59125827-59126842	0	0
chr1:59126899-59127078	0	0
chr1:59127183-59131171	1	0
chr1:59131303-59132710	0	1
chr1:59132898-59133519	0	0
chr1:59133593-59134102	0	0
chr1:59133593-59134304	0	0
chr1:59134238-59134656	0	0
chr1:59134354-59134656	0	0
chr1:59134710-59137542	0	0
chr1:59137630-59139245	0	0
chr1:59139322-59141149	0	0
chr1:59141252-59142598	0	0
chr1:59142728-59147457	0	0
chr1:59148217-59150825	0	0
chr1:59150923-59154710	0	0
chr1:59154788-59155898	0	0
chr1:59155921-59156012	0	0
chr1:59156089-59158533	0	0
chr1:59158603-59160801	0	0
chr1:59160879-59165657	0	0

chr1:59132898-59133519 chr1:59133593-59134102

chr1:59125827-59126842	0	0
chr1:59126899-59127078	0	0
chr1:59127183-59131171	0	0
chr1:59131303-59132710	0	0
chr1:59132898-59133519	1	0
chr1:59133593-59134102	0	1
chr1:59133593-59134304	0	1
chr1:59134238-59134656	0	0
chr1:59134354-59134656	0	0
chr1:59134710-59137542	0	0
chr1:59137630-59139245	0	0
chr1:59139322-59141149	0	0
chr1:59141252-59142598	0	0
chr1:59142728-59147457	0	0
chr1:59148217-59150825	0	0
chr1:59150923-59154710	0	0
chr1:59154788-59155898	0	0
chr1:59155921-59156012	0	0
chr1:59156089-59158533	0	0
chr1:59158603-59160801	0	0
chr1:59160879-59165657	0	0
chr1:59133593-59134304 chr1:59134238-59134656		
chr1:59125827-59126842	0	0
chr1:59126899-59127078	0	0
chr1:59127183-59131171	0	0
chr1:59131303-59132710	0	0
chr1:59132898-59133519	0	0
chr1:59133593-59134102	1	0
chr1:59133593-59134304	1	1
chr1:59134238-59134656	1	1
chr1:59134354-59134656	0	1
chr1:59134710-59137542	0	0
chr1:59137630-59139245	0	0
chr1:59139322-59141149	0	0
chr1:59141252-59142598	0	0
chr1:59142728-59147457	0	0
chr1:59148217-59150825	0	0
chr1:59150923-59154710	0	0
chr1:59154788-59155898	0	0
chr1:59155921-59156012	0	0
chr1:59156089-59158533	0	0
chr1:59158603-59160801	0	0
chr1:59160879-59165657	0	0
chr1:59134354-59134656 chr1:59134710-59137542		
chr1:59125827-59126842	0	0
chr1:59126899-59127078	0	0
chr1:59127183-59131171	0	0
chr1:59131303-59132710	0	0
chr1:59132898-59133519	0	0
chr1:59133593-59134102	0	0
chr1:59133593-59134304	0	0

chr1:59134238-59134656	1	0
chr1:59134354-59134656	1	0
chr1:59134710-59137542	0	1
chr1:59137630-59139245	0	0
chr1:59139322-59141149	0	0
chr1:59141252-59142598	0	0
chr1:59142728-59147457	0	0
chr1:59148217-59150825	0	0
chr1:59150923-59154710	0	0
chr1:59154788-59155898	0	0
chr1:59155921-59156012	0	0
chr1:59156089-59158533	0	0
chr1:59158603-59160801	0	0
chr1:59160879-59165657	0	0
chr1:59137630-59139245 chr1:59139322-59141149		
chr1:59125827-59126842	0	0
chr1:59126899-59127078	0	0
chr1:59127183-59131171	0	0
chr1:59131303-59132710	0	0
chr1:59132898-59133519	0	0
chr1:59133593-59134102	0	0
chr1:59133593-59134304	0	0
chr1:59134238-59134656	0	0
chr1:59134354-59134656	0	0
chr1:59134710-59137542	0	0
chr1:59137630-59139245	1	0
chr1:59139322-59141149	0	1
chr1:59141252-59142598	0	0
chr1:59142728-59147457	0	0
chr1:59148217-59150825	0	0
chr1:59150923-59154710	0	0
chr1:59154788-59155898	0	0
chr1:59155921-59156012	0	0
chr1:59156089-59158533	0	0
chr1:59158603-59160801	0	0
chr1:59160879-59165657	0	0
chr1:59141252-59142598 chr1:59142728-59147457		
chr1:59125827-59126842	0	0
chr1:59126899-59127078	0	0
chr1:59127183-59131171	0	0
chr1:59131303-59132710	0	0
chr1:59132898-59133519	0	0
chr1:59133593-59134102	0	0
chr1:59133593-59134304	0	0
chr1:59134238-59134656	0	0
chr1:59134354-59134656	0	0
chr1:59134710-59137542	0	0
chr1:59137630-59139245	0	0
chr1:59139322-59141149	0	0
chr1:59141252-59142598	1	0
chr1:59142728-59147457	0	1

chr1:59148217-59150825	0	0
chr1:59150923-59154710	0	0
chr1:59154788-59155898	0	0
chr1:59155921-59156012	0	0
chr1:59156089-59158533	0	0
chr1:59158603-59160801	0	0
chr1:59160879-59165657	0	0
chr1:59148217-59150825	chr1:59150923-59154710	
chr1:59125827-59126842	0	0
chr1:59126899-59127078	0	0
chr1:59127183-59131171	0	0
chr1:59131303-59132710	0	0
chr1:59132898-59133519	0	0
chr1:59133593-59134102	0	0
chr1:59133593-59134304	0	0
chr1:59134238-59134656	0	0
chr1:59134354-59134656	0	0
chr1:59134710-59137542	0	0
chr1:59137630-59139245	0	0
chr1:59139322-59141149	0	0
chr1:59141252-59142598	0	0
chr1:59142728-59147457	0	0
chr1:59148217-59150825	1	0
chr1:59150923-59154710	0	1
chr1:59154788-59155898	0	0
chr1:59155921-59156012	0	0
chr1:59156089-59158533	0	0
chr1:59158603-59160801	0	0
chr1:59160879-59165657	0	0
chr1:59154788-59155898	chr1:59155921-59156012	
chr1:59125827-59126842	0	0
chr1:59126899-59127078	0	0
chr1:59127183-59131171	0	0
chr1:59131303-59132710	0	0
chr1:59132898-59133519	0	0
chr1:59133593-59134102	0	0
chr1:59133593-59134304	0	0
chr1:59134238-59134656	0	0
chr1:59134354-59134656	0	0
chr1:59134710-59137542	0	0
chr1:59137630-59139245	0	0
chr1:59139322-59141149	0	0
chr1:59141252-59142598	0	0
chr1:59142728-59147457	0	0
chr1:59148217-59150825	0	0
chr1:59150923-59154710	0	0
chr1:59154788-59155898	1	0
chr1:59155921-59156012	0	1
chr1:59156089-59158533	0	0
chr1:59158603-59160801	0	0
chr1:59160879-59165657	0	0

	chr1:59156089-59158533	chr1:59158603-59160801	
chr1:59125827-59126842	0	0	
chr1:59126899-59127078	0	0	
chr1:59127183-59131171	0	0	
chr1:59131303-59132710	0	0	
chr1:59132898-59133519	0	0	
chr1:59133593-59134102	0	0	
chr1:59133593-59134304	0	0	
chr1:59134238-59134656	0	0	
chr1:59134354-59134656	0	0	
chr1:59134710-59137542	0	0	
chr1:59137630-59139245	0	0	
chr1:59139322-59141149	0	0	
chr1:59141252-59142598	0	0	
chr1:59142728-59147457	0	0	
chr1:59148217-59150825	0	0	
chr1:59150923-59154710	0	0	
chr1:59154788-59155898	0	0	
chr1:59155921-59156012	0	0	
chr1:59156089-59158533	1	0	
chr1:59158603-59160801	0	1	
chr1:59160879-59165657	0	0	
	chr1:59160879-59165657		
chr1:59125827-59126842	0		
chr1:59126899-59127078	0		
chr1:59127183-59131171	0		
chr1:59131303-59132710	0		
chr1:59132898-59133519	0		
chr1:59133593-59134102	0		
chr1:59133593-59134304	0		
chr1:59134238-59134656	0		
chr1:59134354-59134656	0		
chr1:59134710-59137542	0		
chr1:59137630-59139245	0		
chr1:59139322-59141149	0		
chr1:59141252-59142598	0		
chr1:59142728-59147457	0		
chr1:59148217-59150825	0		
chr1:59150923-59154710	0		
chr1:59154788-59155898	0		
chr1:59155921-59156012	0		
chr1:59156089-59158533	0		
chr1:59158603-59160801	0		
chr1:59160879-59165657	1		
\$Rest\$NPHP4			
	chr1:5923465-5923950	chr1:5924093-5924398	chr1:5924577-5925162
chr1:5923465-5923950	1	0	0
chr1:5924093-5924398	0	1	0
chr1:5924577-5925162	0	0	1
chr1:5925333-5926433	0	0	0

chr1:5926518-5927090	0	0	0
chr1:5927175-5927800	0	0	0
chr1:5927956-5933312	0	0	0
chr1:5933395-5934531	0	0	0
chr1:5937358-5940174	0	0	0
chr1:5940299-5947346	0	0	0
chr1:5947526-5950928	0	0	0
chr1:5951088-5964677	0	0	0
chr1:5964864-5965352	0	0	0
chr1:5965543-5965692	0	0	0
chr1:5965843-5967175	0	0	0
chr1:5967282-5969212	0	0	0
chr1:5969273-5987709	0	0	0
chr1:5987847-5993207	0	0	0
chr1:5993389-6007164	0	0	0
chr1:6007290-6008130	0	0	0
chr1:6008311-6012760	0	0	0
chr1:6012896-6021854	0	0	0
chr1:6022009-6027359	0	0	0
chr1:6027423-6029147	0	0	0
chr1:6029319-6038330	0	0	0
chr1:6038473-6046215	0	0	0
chr1:6046387-6052304	0	0	0
chr1:5934717-5934934	0	0	0
chr1:5965840-5967175	0	0	0
chr1:5936583-5937153	0	0	0
chr1:5937358-5939406	0	0	0
chr1:5939692-5940174	0	0	0
chr1:5925333-5926433	chr1:5926518-5927090	chr1:5927175-5927800	
chr1:5923465-5923950	0	0	0
chr1:5924093-5924398	0	0	0
chr1:5924577-5925162	0	0	0
chr1:5925333-5926433	1	0	0
chr1:5926518-5927090	0	1	0
chr1:5927175-5927800	0	0	1
chr1:5927956-5933312	0	0	0
chr1:5933395-5934531	0	0	0
chr1:5937358-5940174	0	0	0
chr1:5940299-5947346	0	0	0
chr1:5947526-5950928	0	0	0
chr1:5951088-5964677	0	0	0
chr1:5964864-5965352	0	0	0
chr1:5965543-5965692	0	0	0
chr1:5965843-5967175	0	0	0
chr1:5967282-5969212	0	0	0
chr1:5969273-5987709	0	0	0
chr1:5987847-5993207	0	0	0
chr1:5993389-6007164	0	0	0
chr1:6007290-6008130	0	0	0
chr1:6008311-6012760	0	0	0
chr1:6012896-6021854	0	0	0

chr1:6022009-6027359	0	0	0
chr1:6027423-6029147	0	0	0
chr1:6029319-6038330	0	0	0
chr1:6038473-6046215	0	0	0
chr1:6046387-6052304	0	0	0
chr1:5934717-5934934	0	0	0
chr1:5965840-5967175	0	0	0
chr1:5936583-5937153	0	0	0
chr1:5937358-5939406	0	0	0
chr1:5939692-5940174	0	0	0
chr1:5927956-5933312 chr1:5933395-5934531 chr1:5937358-5940174			
chr1:5923465-5923950	0	0	0
chr1:5924093-5924398	0	0	0
chr1:5924577-5925162	0	0	0
chr1:5925333-5926433	0	0	0
chr1:5926518-5927090	0	0	0
chr1:5927175-5927800	0	0	0
chr1:5927956-5933312	1	0	0
chr1:5933395-5934531	0	1	0
chr1:5937358-5940174	0	0	1
chr1:5940299-5947346	0	0	0
chr1:5947526-5950928	0	0	0
chr1:5951088-5964677	0	0	0
chr1:5964864-5965352	0	0	0
chr1:5965543-5965692	0	0	0
chr1:5965843-5967175	0	0	0
chr1:5967282-5969212	0	0	0
chr1:5969273-5987709	0	0	0
chr1:5987847-5993207	0	0	0
chr1:5993389-6007164	0	0	0
chr1:6007290-6008130	0	0	0
chr1:6008311-6012760	0	0	0
chr1:6012896-6021854	0	0	0
chr1:6022009-6027359	0	0	0
chr1:6027423-6029147	0	0	0
chr1:6029319-6038330	0	0	0
chr1:6038473-6046215	0	0	0
chr1:6046387-6052304	0	0	0
chr1:5934717-5934934	0	0	0
chr1:5965840-5967175	0	0	0
chr1:5936583-5937153	0	0	0
chr1:5937358-5939406	0	0	1
chr1:5939692-5940174	0	0	1
chr1:5940299-5947346 chr1:5947526-5950928 chr1:5951088-5964677			
chr1:5923465-5923950	0	0	0
chr1:5924093-5924398	0	0	0
chr1:5924577-5925162	0	0	0
chr1:5925333-5926433	0	0	0
chr1:5926518-5927090	0	0	0
chr1:5927175-5927800	0	0	0
chr1:5927956-5933312	0	0	0

chr1:5933395-5934531	0	0	0
chr1:5937358-5940174	0	0	0
chr1:5940299-5947346	1	0	0
chr1:5947526-5950928	0	1	0
chr1:5951088-5964677	0	0	1
chr1:5964864-5965352	0	0	0
chr1:5965543-5965692	0	0	0
chr1:5965843-5967175	0	0	0
chr1:5967282-5969212	0	0	0
chr1:5969273-5987709	0	0	0
chr1:5987847-5993207	0	0	0
chr1:5993389-6007164	0	0	0
chr1:6007290-6008130	0	0	0
chr1:6008311-6012760	0	0	0
chr1:6012896-6021854	0	0	0
chr1:6022009-6027359	0	0	0
chr1:6027423-6029147	0	0	0
chr1:6029319-6038330	0	0	0
chr1:6038473-6046215	0	0	0
chr1:6046387-6052304	0	0	0
chr1:5934717-5934934	0	0	0
chr1:5965840-5967175	0	0	0
chr1:5936583-5937153	0	0	0
chr1:5937358-5939406	0	0	0
chr1:5939692-5940174	0	0	0
chr1:5964864-5965352 chr1:5965543-5965692 chr1:5965843-5967175			
chr1:5923465-5923950	0	0	0
chr1:5924093-5924398	0	0	0
chr1:5924577-5925162	0	0	0
chr1:5925333-5926433	0	0	0
chr1:5926518-5927090	0	0	0
chr1:5927175-5927800	0	0	0
chr1:5927956-5933312	0	0	0
chr1:5933395-5934531	0	0	0
chr1:5937358-5940174	0	0	0
chr1:5940299-5947346	0	0	0
chr1:5947526-5950928	0	0	0
chr1:5951088-5964677	0	0	0
chr1:5964864-5965352	1	0	0
chr1:5965543-5965692	0	1	0
chr1:5965843-5967175	0	0	1
chr1:5967282-5969212	0	0	0
chr1:5969273-5987709	0	0	0
chr1:5987847-5993207	0	0	0
chr1:5993389-6007164	0	0	0
chr1:6007290-6008130	0	0	0
chr1:6008311-6012760	0	0	0
chr1:6012896-6021854	0	0	0
chr1:6022009-6027359	0	0	0
chr1:6027423-6029147	0	0	0
chr1:6029319-6038330	0	0	0

chr1:6038473-6046215	0	0	0
chr1:6046387-6052304	0	0	0
chr1:5934717-5934934	0	0	0
chr1:5965840-5967175	0	0	1
chr1:5936583-5937153	0	0	0
chr1:5937358-5939406	0	0	0
chr1:5939692-5940174	0	0	0
chr1:5967282-5969212	chr1:5969273-5987709	chr1:5987847-5993207	
chr1:5923465-5923950	0	0	0
chr1:5924093-5924398	0	0	0
chr1:5924577-5925162	0	0	0
chr1:5925333-5926433	0	0	0
chr1:5926518-5927090	0	0	0
chr1:5927175-5927800	0	0	0
chr1:5927956-5933312	0	0	0
chr1:5933395-5934531	0	0	0
chr1:5937358-5940174	0	0	0
chr1:5940299-5947346	0	0	0
chr1:5947526-5950928	0	0	0
chr1:5951088-5964677	0	0	0
chr1:5964864-5965352	0	0	0
chr1:5965543-5965692	0	0	0
chr1:5965843-5967175	0	0	0
chr1:5967282-5969212	1	0	0
chr1:5969273-5987709	0	1	0
chr1:5987847-5993207	0	0	1
chr1:5993389-6007164	0	0	0
chr1:6007290-6008130	0	0	0
chr1:6008311-6012760	0	0	0
chr1:6012896-6021854	0	0	0
chr1:6022009-6027359	0	0	0
chr1:6027423-6029147	0	0	0
chr1:6029319-6038330	0	0	0
chr1:6038473-6046215	0	0	0
chr1:6046387-6052304	0	0	0
chr1:5934717-5934934	0	0	0
chr1:5965840-5967175	0	0	0
chr1:5936583-5937153	0	0	0
chr1:5937358-5939406	0	0	0
chr1:5939692-5940174	0	0	0
chr1:5993389-6007164	chr1:6007290-6008130	chr1:6008311-6012760	
chr1:5923465-5923950	0	0	0
chr1:5924093-5924398	0	0	0
chr1:5924577-5925162	0	0	0
chr1:5925333-5926433	0	0	0
chr1:5926518-5927090	0	0	0
chr1:5927175-5927800	0	0	0
chr1:5927956-5933312	0	0	0
chr1:5933395-5934531	0	0	0
chr1:5937358-5940174	0	0	0
chr1:5940299-5947346	0	0	0

chr1:5947526-5950928	0	0	0
chr1:5951088-5964677	0	0	0
chr1:5964864-5965352	0	0	0
chr1:5965543-5965692	0	0	0
chr1:5965843-5967175	0	0	0
chr1:5967282-5969212	0	0	0
chr1:5969273-5987709	0	0	0
chr1:5987847-5993207	0	0	0
chr1:5993389-6007164	1	0	0
chr1:6007290-6008130	0	1	0
chr1:6008311-6012760	0	0	1
chr1:6012896-6021854	0	0	0
chr1:6022009-6027359	0	0	0
chr1:6027423-6029147	0	0	0
chr1:6029319-6038330	0	0	0
chr1:6038473-6046215	0	0	0
chr1:6046387-6052304	0	0	0
chr1:5934717-5934934	0	0	0
chr1:5965840-5967175	0	0	0
chr1:5936583-5937153	0	0	0
chr1:5937358-5939406	0	0	0
chr1:5939692-5940174	0	0	0
chr1:6012896-6021854	chr1:6022009-6027359	chr1:6027423-6029147	
chr1:5923465-5923950	0	0	0
chr1:5924093-5924398	0	0	0
chr1:5924577-5925162	0	0	0
chr1:5925333-5926433	0	0	0
chr1:5926518-5927090	0	0	0
chr1:5927175-5927800	0	0	0
chr1:5927956-5933312	0	0	0
chr1:5933395-5934531	0	0	0
chr1:5937358-5940174	0	0	0
chr1:5940299-5947346	0	0	0
chr1:5947526-5950928	0	0	0
chr1:5951088-5964677	0	0	0
chr1:5964864-5965352	0	0	0
chr1:5965543-5965692	0	0	0
chr1:5965843-5967175	0	0	0
chr1:5967282-5969212	0	0	0
chr1:5969273-5987709	0	0	0
chr1:5987847-5993207	0	0	0
chr1:5993389-6007164	0	0	0
chr1:6007290-6008130	0	0	0
chr1:6008311-6012760	0	0	0
chr1:6012896-6021854	1	0	0
chr1:6022009-6027359	0	1	0
chr1:6027423-6029147	0	0	1
chr1:6029319-6038330	0	0	0
chr1:6038473-6046215	0	0	0
chr1:6046387-6052304	0	0	0
chr1:5934717-5934934	0	0	0

chr1:5965840-5967175	0	0	0
chr1:5936583-5937153	0	0	0
chr1:5937358-5939406	0	0	0
chr1:5939692-5940174	0	0	0
chr1:5923465-5923950	0	0	0
chr1:5924093-5924398	0	0	0
chr1:5924577-5925162	0	0	0
chr1:5925333-5926433	0	0	0
chr1:5926518-5927090	0	0	0
chr1:5927175-5927800	0	0	0
chr1:5927956-5933312	0	0	0
chr1:5933395-5934531	0	0	0
chr1:5937358-5940174	0	0	0
chr1:5940299-5947346	0	0	0
chr1:5947526-5950928	0	0	0
chr1:5951088-5964677	0	0	0
chr1:5964864-5965352	0	0	0
chr1:5965543-5965692	0	0	0
chr1:5965843-5967175	0	0	0
chr1:5967282-5969212	0	0	0
chr1:5969273-5987709	0	0	0
chr1:5987847-5993207	0	0	0
chr1:5993389-6007164	0	0	0
chr1:6007290-6008130	0	0	0
chr1:6008311-6012760	0	0	0
chr1:6012896-6021854	0	0	0
chr1:6022009-6027359	0	0	0
chr1:6027423-6029147	0	0	0
chr1:6029319-6038330	1	0	0
chr1:6038473-6046215	0	1	0
chr1:6046387-6052304	0	0	1
chr1:5934717-5934934	0	0	0
chr1:5965840-5967175	0	0	0
chr1:5936583-5937153	0	0	0
chr1:5937358-5939406	0	0	0
chr1:5939692-5940174	0	0	0
chr1:5923465-5923950	0	0	0
chr1:5924093-5924398	0	0	0
chr1:5924577-5925162	0	0	0
chr1:5925333-5926433	0	0	0
chr1:5926518-5927090	0	0	0
chr1:5927175-5927800	0	0	0
chr1:5927956-5933312	0	0	0
chr1:5933395-5934531	0	0	0
chr1:5937358-5940174	0	0	0
chr1:5940299-5947346	0	0	0
chr1:5947526-5950928	0	0	0
chr1:5951088-5964677	0	0	0
chr1:5964864-5965352	0	0	0

chr1:5965543-5965692	0	0	0
chr1:5965843-5967175	0	1	0
chr1:5967282-5969212	0	0	0
chr1:5969273-5987709	0	0	0
chr1:5987847-5993207	0	0	0
chr1:5993389-6007164	0	0	0
chr1:6007290-6008130	0	0	0
chr1:6008311-6012760	0	0	0
chr1:6012896-6021854	0	0	0
chr1:6022009-6027359	0	0	0
chr1:6027423-6029147	0	0	0
chr1:6029319-6038330	0	0	0
chr1:6038473-6046215	0	0	0
chr1:6046387-6052304	0	0	0
chr1:5934717-5934934	1	0	0
chr1:5965840-5967175	0	1	0
chr1:5936583-5937153	0	0	1
chr1:5937358-5939406	0	0	0
chr1:5939692-5940174	0	0	0
chr1:5937358-5939406 chr1:5939692-5940174			
chr1:5923465-5923950	0	0	
chr1:5924093-5924398	0	0	
chr1:5924577-5925162	0	0	
chr1:5925333-5926433	0	0	
chr1:5926518-5927090	0	0	
chr1:5927175-5927800	0	0	
chr1:5927956-5933312	0	0	
chr1:5933395-5934531	0	0	
chr1:5937358-5940174	1	1	
chr1:5940299-5947346	0	0	
chr1:5947526-5950928	0	0	
chr1:5951088-5964677	0	0	
chr1:5964864-5965352	0	0	
chr1:5965543-5965692	0	0	
chr1:5965843-5967175	0	0	
chr1:5967282-5969212	0	0	
chr1:5969273-5987709	0	0	
chr1:5987847-5993207	0	0	
chr1:5993389-6007164	0	0	
chr1:6007290-6008130	0	0	
chr1:6008311-6012760	0	0	
chr1:6012896-6021854	0	0	
chr1:6022009-6027359	0	0	
chr1:6027423-6029147	0	0	
chr1:6029319-6038330	0	0	
chr1:6038473-6046215	0	0	
chr1:6046387-6052304	0	0	
chr1:5934717-5934934	0	0	
chr1:5965840-5967175	0	0	
chr1:5936583-5937153	0	0	
chr1:5937358-5939406	1	0	

chr1:5939692-5940174	0	1
----------------------	---	---

\$Rest\$PEX14

	chr1:10637247-10637871	chr1:10659423-10678389
chr1:10637247-10637871	1	0
chr1:10659423-10678389	0	1
chr1:10678474-10683076	0	0
chr1:10683178-10684397	0	0
chr1:10684494-10687329	0	0
chr1:10687420-10689588	0	0
chr1:10596354-10659295	1	0
chr1:10596354-10678389	1	1
	chr1:10678474-10683076	chr1:10683178-10684397
chr1:10637247-10637871	0	0
chr1:10659423-10678389	0	0
chr1:10678474-10683076	1	0
chr1:10683178-10684397	0	1
chr1:10684494-10687329	0	0
chr1:10687420-10689588	0	0
chr1:10596354-10659295	0	0
chr1:10596354-10678389	0	0
	chr1:10684494-10687329	chr1:10687420-10689588
chr1:10637247-10637871	0	0
chr1:10659423-10678389	0	0
chr1:10678474-10683076	0	0
chr1:10683178-10684397	0	0
chr1:10684494-10687329	1	0
chr1:10687420-10689588	0	1
chr1:10596354-10659295	0	0
chr1:10596354-10678389	0	0
	chr1:10596354-10659295	chr1:10596354-10678389
chr1:10637247-10637871	1	1
chr1:10659423-10678389	0	1
chr1:10678474-10683076	0	0
chr1:10683178-10684397	0	0
chr1:10684494-10687329	0	0
chr1:10687420-10689588	0	0
chr1:10596354-10659295	1	1
chr1:10596354-10678389	1	1

\$Rest\$PIP5K1A

	chr1:151171557-151196721	chr1:151171557-151196724
chr1:151171557-151196721	1	1
chr1:151171557-151196724	1	1
chr1:151196755-151199796	0	0
chr1:151199876-151204147	0	0
chr1:151204277-151204724	0	0
chr1:151204841-151205027	0	0
chr1:151205179-151206673	0	0
chr1:151206972-151209034	0	0
chr1:151209239-151210658	0	0

chr1:151209239-151211606	0	0
chr1:151210741-151211606	0	0
chr1:151211654-151212431	0	0
chr1:151212515-151214599	0	0
chr1:151212515-151219396	0	0
chr1:151214745-151214914	0	0
chr1:151215043-151219396	0	0
chr1:151219441-151220339	0	0
chr1:151196755-151196847	0	0
chr1:151196882-151199796	0	0
chr1:151212515-151214914	0	0
chr1:151196755-151199796	chr1:151199876-151204147	
chr1:151171557-151196721	0	0
chr1:151171557-151196724	0	0
chr1:151196755-151199796	1	0
chr1:151199876-151204147	0	1
chr1:151204277-151204724	0	0
chr1:151204841-151205027	0	0
chr1:151205179-151206673	0	0
chr1:151206972-151209034	0	0
chr1:151209239-151210658	0	0
chr1:151209239-151211606	0	0
chr1:151210741-151211606	0	0
chr1:151211654-151212431	0	0
chr1:151212515-151214599	0	0
chr1:151212515-151219396	0	0
chr1:151214745-151214914	0	0
chr1:151215043-151219396	0	0
chr1:151219441-151220339	0	0
chr1:151196755-151196847	1	0
chr1:151196882-151199796	1	0
chr1:151212515-151214914	0	0
chr1:151204277-151204724	chr1:151204841-151205027	
chr1:151171557-151196721	0	0
chr1:151171557-151196724	0	0
chr1:151196755-151199796	0	0
chr1:151199876-151204147	0	0
chr1:151204277-151204724	1	0
chr1:151204841-151205027	0	1
chr1:151205179-151206673	0	0
chr1:151206972-151209034	0	0
chr1:151209239-151210658	0	0
chr1:151209239-151211606	0	0
chr1:151210741-151211606	0	0
chr1:151211654-151212431	0	0
chr1:151212515-151214599	0	0
chr1:151212515-151219396	0	0
chr1:151214745-151214914	0	0
chr1:151215043-151219396	0	0
chr1:151219441-151220339	0	0
chr1:151196755-151196847	0	0

chr1:151196882-151199796	0	0
chr1:151212515-151214914	0	0
chr1:151205179-151206673	chr1:151206972-151209034	
chr1:151171557-151196721	0	0
chr1:151171557-151196724	0	0
chr1:151196755-151199796	0	0
chr1:151199876-151204147	0	0
chr1:151204277-151204724	0	0
chr1:151204841-151205027	0	0
chr1:151205179-151206673	1	0
chr1:151206972-151209034	0	1
chr1:151209239-151210658	0	0
chr1:151209239-151211606	0	0
chr1:151210741-151211606	0	0
chr1:151211654-151212431	0	0
chr1:151212515-151214599	0	0
chr1:151212515-151219396	0	0
chr1:151214745-151214914	0	0
chr1:151215043-151219396	0	0
chr1:151219441-151220339	0	0
chr1:151196755-151196847	0	0
chr1:151196882-151199796	0	0
chr1:151212515-151214914	0	0
chr1:151209239-151210658	chr1:151209239-151211606	
chr1:151171557-151196721	0	0
chr1:151171557-151196724	0	0
chr1:151196755-151199796	0	0
chr1:151199876-151204147	0	0
chr1:151204277-151204724	0	0
chr1:151204841-151205027	0	0
chr1:151205179-151206673	0	0
chr1:151206972-151209034	0	0
chr1:151209239-151210658	1	1
chr1:151209239-151211606	1	1
chr1:151210741-151211606	0	1
chr1:151211654-151212431	0	0
chr1:151212515-151214599	0	0
chr1:151212515-151219396	0	0
chr1:151214745-151214914	0	0
chr1:151215043-151219396	0	0
chr1:151219441-151220339	0	0
chr1:151196755-151196847	0	0
chr1:151196882-151199796	0	0
chr1:151212515-151214914	0	0
chr1:151210741-151211606	chr1:151211654-151212431	
chr1:151171557-151196721	0	0
chr1:151171557-151196724	0	0
chr1:151196755-151199796	0	0
chr1:151199876-151204147	0	0
chr1:151204277-151204724	0	0
chr1:151204841-151205027	0	0

chr1:151205179-151206673	0	0
chr1:151206972-151209034	0	0
chr1:151209239-151210658	0	0
chr1:151209239-151211606	1	0
chr1:151210741-151211606	1	0
chr1:151211654-151212431	0	1
chr1:151212515-151214599	0	0
chr1:151212515-151219396	0	0
chr1:151214745-151214914	0	0
chr1:151215043-151219396	0	0
chr1:151219441-151220339	0	0
chr1:151196755-151196847	0	0
chr1:151196882-151199796	0	0
chr1:151212515-151214914	0	0
chr1:151212515-151214599 chr1:151212515-151219396		
chr1:151171557-151196721	0	0
chr1:151171557-151196724	0	0
chr1:151196755-151199796	0	0
chr1:151199876-151204147	0	0
chr1:151204277-151204724	0	0
chr1:151204841-151205027	0	0
chr1:151205179-151206673	0	0
chr1:151206972-151209034	0	0
chr1:151209239-151210658	0	0
chr1:151209239-151211606	0	0
chr1:151210741-151211606	0	0
chr1:151211654-151212431	0	0
chr1:151212515-151214599	1	1
chr1:151212515-151219396	1	1
chr1:151214745-151214914	0	1
chr1:151215043-151219396	0	1
chr1:151219441-151220339	0	0
chr1:151196755-151196847	0	0
chr1:151196882-151199796	0	0
chr1:151212515-151214914	1	1
chr1:151214745-151214914 chr1:151215043-151219396		
chr1:151171557-151196721	0	0
chr1:151171557-151196724	0	0
chr1:151196755-151199796	0	0
chr1:151199876-151204147	0	0
chr1:151204277-151204724	0	0
chr1:151204841-151205027	0	0
chr1:151205179-151206673	0	0
chr1:151206972-151209034	0	0
chr1:151209239-151210658	0	0
chr1:151209239-151211606	0	0
chr1:151210741-151211606	0	0
chr1:151211654-151212431	0	0
chr1:151212515-151214599	0	0
chr1:151212515-151219396	1	1
chr1:151214745-151214914	1	0

chr1:151215043-151219396	0	1
chr1:151219441-151220339	0	0
chr1:151196755-151196847	0	0
chr1:151196882-151199796	0	0
chr1:151212515-151214914	1	0
chr1:151219441-151220339	chr1:151196755-151196847	
chr1:151171557-151196721	0	0
chr1:151171557-151196724	0	0
chr1:151196755-151199796	0	1
chr1:151199876-151204147	0	0
chr1:151204277-151204724	0	0
chr1:151204841-151205027	0	0
chr1:151205179-151206673	0	0
chr1:151206972-151209034	0	0
chr1:151209239-151210658	0	0
chr1:151209239-151211606	0	0
chr1:151210741-151211606	0	0
chr1:151211654-151212431	0	0
chr1:151212515-151214599	0	0
chr1:151212515-151219396	0	0
chr1:151214745-151214914	0	0
chr1:151215043-151219396	0	0
chr1:151219441-151220339	1	0
chr1:151196755-151196847	0	1
chr1:151196882-151199796	0	0
chr1:151212515-151214914	0	0
chr1:151196882-151199796	chr1:151212515-151214914	
chr1:151171557-151196721	0	0
chr1:151171557-151196724	0	0
chr1:151196755-151199796	1	0
chr1:151199876-151204147	0	0
chr1:151204277-151204724	0	0
chr1:151204841-151205027	0	0
chr1:151205179-151206673	0	0
chr1:151206972-151209034	0	0
chr1:151209239-151210658	0	0
chr1:151209239-151211606	0	0
chr1:151210741-151211606	0	0
chr1:151211654-151212431	0	0
chr1:151212515-151214599	0	1
chr1:151212515-151219396	0	1
chr1:151214745-151214914	0	1
chr1:151215043-151219396	0	0
chr1:151219441-151220339	0	0
chr1:151196755-151196847	0	0
chr1:151196882-151199796	1	0
chr1:151212515-151214914	0	1
\$Rest\$PSMB2		
chr1:36040299-36042923	chr1:36068975-36070834	
chr1:36040299-36042923	1	0

chr1:36068975-36070834	0	1
chr1:36070883-36074847	0	0
chr1:36075009-36096875	0	0
chr1:36096945-36101911	0	0
chr1:36102033-36106943	0	0
chr1:36043093-36070834	0	1
chr1:36070883-36074847 chr1:36075009-36096875		
chr1:36040299-36042923	0	0
chr1:36068975-36070834	0	0
chr1:36070883-36074847	1	0
chr1:36075009-36096875	0	1
chr1:36096945-36101911	0	0
chr1:36102033-36106943	0	0
chr1:36043093-36070834	0	0
chr1:36096945-36101911 chr1:36102033-36106943		
chr1:36040299-36042923	0	0
chr1:36068975-36070834	0	0
chr1:36070883-36074847	0	0
chr1:36075009-36096875	0	0
chr1:36096945-36101911	1	0
chr1:36102033-36106943	0	1
chr1:36043093-36070834	0	0
chr1:36043093-36070834		
chr1:36040299-36042923	0	
chr1:36068975-36070834	1	
chr1:36070883-36074847	0	
chr1:36075009-36096875	0	
chr1:36096945-36101911	0	
chr1:36102033-36106943	0	
chr1:36043093-36070834	1	
\$Rest\$RBBP4		
chr1:33116923-33117515 chr1:33117662-33123028		
chr1:33116923-33117515	1	0
chr1:33117662-33123028	0	1
chr1:33123173-33133826	0	0
chr1:33133999-33134340	0	0
chr1:33134455-33134573	0	0
chr1:33134733-33134832	0	0
chr1:33134958-33135087	0	0
chr1:33135164-33138051	0	0
chr1:33138127-33138243	0	0
chr1:33138300-33138392	0	0
chr1:33138502-33145241	0	0
chr1:33116923-33117518	1	0
chr1:33123173-33133826 chr1:33133999-33134340		
chr1:33116923-33117515	0	0
chr1:33117662-33123028	0	0
chr1:33123173-33133826	1	0
chr1:33133999-33134340	0	1
chr1:33134455-33134573	0	0

chr1:33134733-33134832	0	0
chr1:33134958-33135087	0	0
chr1:33135164-33138051	0	0
chr1:33138127-33138243	0	0
chr1:33138300-33138392	0	0
chr1:33138502-33145241	0	0
chr1:33116923-33117518	0	0
chr1:33116923-33117515	0	0
chr1:33117662-33123028	0	0
chr1:33123173-33133826	0	0
chr1:33133999-33134340	0	0
chr1:33134455-33134573	1	0
chr1:33134733-33134832	0	1
chr1:33134958-33135087	0	0
chr1:33135164-33138051	0	0
chr1:33138127-33138243	0	0
chr1:33138300-33138392	0	0
chr1:33138502-33145241	0	0
chr1:33116923-33117518	0	0
chr1:33116923-33117515	0	0
chr1:33117662-33123028	0	0
chr1:33123173-33133826	0	0
chr1:33133999-33134340	0	0
chr1:33134455-33134573	0	0
chr1:33134733-33134832	0	0
chr1:33134958-33135087	1	0
chr1:33135164-33138051	0	1
chr1:33138127-33138243	0	0
chr1:33138300-33138392	0	0
chr1:33138502-33145241	0	0
chr1:33116923-33117518	0	0
chr1:33116923-33117515	0	0
chr1:33117662-33123028	0	0
chr1:33123173-33133826	0	0
chr1:33133999-33134340	0	0
chr1:33134455-33134573	0	0
chr1:33134733-33134832	0	0
chr1:33134958-33135087	0	0
chr1:33135164-33138051	0	0
chr1:33138127-33138243	1	0
chr1:33138300-33138392	0	1
chr1:33138502-33145241	0	0
chr1:33116923-33117518	0	0
chr1:33116923-33117515	0	0
chr1:33117662-33123028	0	0
chr1:33123173-33133826	0	0
chr1:33133999-33134340	0	0
chr1:33134455-33134573	0	0
chr1:33134733-33134832	0	0
chr1:33134958-33135087	0	0
chr1:33135164-33138051	0	0
chr1:33138127-33138243	1	0
chr1:33138300-33138392	0	1
chr1:33138502-33145241	0	0
chr1:33116923-33117518	0	0
chr1:33116923-33117515	0	1
chr1:33117662-33123028	0	0
chr1:33123173-33133826	0	0
chr1:33133999-33134340	0	0

chr1:33134455-33134573	0	0
chr1:33134733-33134832	0	0
chr1:33134958-33135087	0	0
chr1:33135164-33138051	0	0
chr1:33138127-33138243	0	0
chr1:33138300-33138392	0	0
chr1:33138502-33145241	1	0
chr1:33116923-33117518	0	1

\$Rest\$RBBP5

	chr1:205057943-205064001	chr1:205057943-205064115
chr1:205057943-205064001	1	1
chr1:205057943-205064115	1	1
chr1:205064192-205065810	0	0
chr1:205066039-205066454	0	0
chr1:205066523-205068117	0	0
chr1:205068234-205068869	0	0
chr1:205068940-205069039	0	0
chr1:205069192-205069280	0	0
chr1:205069399-205070728	0	0
chr1:205070837-205072985	0	0
chr1:205073147-205074156	0	0
chr1:205074296-205083917	0	0
chr1:205084033-205084986	0	0
chr1:205084089-205084986	0	0
chr1:205085011-205090983	0	0
chr1:205057940-205064001	1	1
	chr1:205064192-205065810	chr1:205066039-205066454
chr1:205057943-205064001	0	0
chr1:205057943-205064115	0	0
chr1:205064192-205065810	1	0
chr1:205066039-205066454	0	1
chr1:205066523-205068117	0	0
chr1:205068234-205068869	0	0
chr1:205068940-205069039	0	0
chr1:205069192-205069280	0	0
chr1:205069399-205070728	0	0
chr1:205070837-205072985	0	0
chr1:205073147-205074156	0	0
chr1:205074296-205083917	0	0
chr1:205084033-205084986	0	0
chr1:205084089-205084986	0	0
chr1:205085011-205090983	0	0
chr1:205057940-205064001	0	0
	chr1:205066523-205068117	chr1:205068234-205068869
chr1:205057943-205064001	0	0
chr1:205057943-205064115	0	0
chr1:205064192-205065810	0	0
chr1:205066039-205066454	0	0
chr1:205066523-205068117	1	0
chr1:205068234-205068869	0	1

chr1:205068940-205069039	0	0
chr1:205069192-205069280	0	0
chr1:205069399-205070728	0	0
chr1:205070837-205072985	0	0
chr1:205073147-205074156	0	0
chr1:205074296-205083917	0	0
chr1:205084033-205084986	0	0
chr1:205084089-205084986	0	0
chr1:205085011-205090983	0	0
chr1:205057940-205064001	0	0
chr1:205068940-205069039	chr1:205069192-205069280	
chr1:205057943-205064001	0	0
chr1:205057943-205064115	0	0
chr1:205064192-205065810	0	0
chr1:205066039-205066454	0	0
chr1:205066523-205068117	0	0
chr1:205068234-205068869	0	0
chr1:205068940-205069039	1	0
chr1:205069192-205069280	0	1
chr1:205069399-205070728	0	0
chr1:205070837-205072985	0	0
chr1:205073147-205074156	0	0
chr1:205074296-205083917	0	0
chr1:205084033-205084986	0	0
chr1:205084089-205084986	0	0
chr1:205085011-205090983	0	0
chr1:205057940-205064001	0	0
chr1:205069399-205070728	chr1:205070837-205072985	
chr1:205057943-205064001	0	0
chr1:205057943-205064115	0	0
chr1:205064192-205065810	0	0
chr1:205066039-205066454	0	0
chr1:205066523-205068117	0	0
chr1:205068234-205068869	0	0
chr1:205068940-205069039	0	0
chr1:205069192-205069280	0	0
chr1:205069399-205070728	1	0
chr1:205070837-205072985	0	1
chr1:205073147-205074156	0	0
chr1:205074296-205083917	0	0
chr1:205084033-205084986	0	0
chr1:205084089-205084986	0	0
chr1:205085011-205090983	0	0
chr1:205057940-205064001	0	0
chr1:205073147-205074156	chr1:205074296-205083917	
chr1:205057943-205064001	0	0
chr1:205057943-205064115	0	0
chr1:205064192-205065810	0	0
chr1:205066039-205066454	0	0
chr1:205066523-205068117	0	0
chr1:205068234-205068869	0	0

chr1:205068940-205069039	0	0
chr1:205069192-205069280	0	0
chr1:205069399-205070728	0	0
chr1:205070837-205072985	0	0
chr1:205073147-205074156	1	0
chr1:205074296-205083917	0	1
chr1:205084033-205084986	0	0
chr1:205084089-205084986	0	0
chr1:205085011-205090983	0	0
chr1:205057940-205064001	0	0
chr1:205084033-205084986 chr1:205084089-205084986		
chr1:205057943-205064001	0	0
chr1:205057943-205064115	0	0
chr1:205064192-205065810	0	0
chr1:205066039-205066454	0	0
chr1:205066523-205068117	0	0
chr1:205068234-205068869	0	0
chr1:205068940-205069039	0	0
chr1:205069192-205069280	0	0
chr1:205069399-205070728	0	0
chr1:205070837-205072985	0	0
chr1:205073147-205074156	0	0
chr1:205074296-205083917	0	0
chr1:205084033-205084986	1	1
chr1:205084089-205084986	1	1
chr1:205085011-205090983	0	0
chr1:205057940-205064001	0	0
chr1:205085011-205090983 chr1:205057940-205064001		
chr1:205057943-205064001	0	1
chr1:205057943-205064115	0	1
chr1:205064192-205065810	0	0
chr1:205066039-205066454	0	0
chr1:205066523-205068117	0	0
chr1:205068234-205068869	0	0
chr1:205068940-205069039	0	0
chr1:205069192-205069280	0	0
chr1:205069399-205070728	0	0
chr1:205070837-205072985	0	0
chr1:205073147-205074156	0	0
chr1:205074296-205083917	0	0
chr1:205084033-205084986	0	0
chr1:205084089-205084986	0	0
chr1:205085011-205090983	1	0
chr1:205057940-205064001	0	1
\$Rest\$RERE		
chr1:8415180-8415479 chr1:8415659-8416160 chr1:8416306-8418256		
chr1:8415180-8415479	1	0
chr1:8415659-8416160	0	1
chr1:8416306-8418256	0	1
chr1:8418976-8419824	0	0

chr1:8420046-8420172	0	0	0
chr1:8421550-8421823	0	0	0
chr1:8421936-8422743	0	0	0
chr1:8422904-8424116	0	0	0
chr1:8424315-8424806	0	0	0
chr1:8424898-8425872	0	0	0
chr1:8426034-8482787	0	0	0
chr1:8482867-8525985	0	0	0
chr1:8526083-8555123	0	0	0
chr1:8555222-8557465	0	0	0
chr1:8557589-8568686	0	0	0
chr1:8568734-8601273	0	0	0
chr1:8601377-8616534	0	0	0
chr1:8616630-8617477	0	0	0
chr1:8617582-8674620	0	0	0
chr1:8674745-8684369	0	0	0
chr1:8684439-8716032	0	0	0
chr1:8716500-8813490	0	0	0
chr1:8716500-8877219	0	0	0
chr1:8482867-8483621	0	0	0
chr1:8852647-8877219	0	0	0
chr1:8716500-8852463	0	0	0
chr1:8418976-8419824 chr1:8420046-8420172 chr1:8421550-8421823			
chr1:8415180-8415479	0	0	0
chr1:8415659-8416160	0	0	0
chr1:8416306-8418256	0	0	0
chr1:8418976-8419824	1	0	0
chr1:8420046-8420172	0	1	0
chr1:8421550-8421823	0	0	1
chr1:8421936-8422743	0	0	0
chr1:8422904-8424116	0	0	0
chr1:8424315-8424806	0	0	0
chr1:8424898-8425872	0	0	0
chr1:8426034-8482787	0	0	0
chr1:8482867-8525985	0	0	0
chr1:8526083-8555123	0	0	0
chr1:8555222-8557465	0	0	0
chr1:8557589-8568686	0	0	0
chr1:8568734-8601273	0	0	0
chr1:8601377-8616534	0	0	0
chr1:8616630-8617477	0	0	0
chr1:8617582-8674620	0	0	0
chr1:8674745-8684369	0	0	0
chr1:8684439-8716032	0	0	0
chr1:8716500-8813490	0	0	0
chr1:8716500-8877219	0	0	0
chr1:8482867-8483621	0	0	0
chr1:8852647-8877219	0	0	0
chr1:8716500-8852463	0	0	0
chr1:8421936-8422743 chr1:8422904-8424116 chr1:8424315-8424806			
chr1:8415180-8415479	0	0	0

chr1:8415659-8416160	0	0	0
chr1:8416306-8418256	0	0	0
chr1:8418976-8419824	0	0	0
chr1:8420046-8420172	0	0	0
chr1:8421550-8421823	0	0	0
chr1:8421936-8422743	1	0	0
chr1:8422904-8424116	0	1	0
chr1:8424315-8424806	0	0	1
chr1:8424898-8425872	0	0	0
chr1:8426034-8482787	0	0	0
chr1:8482867-8525985	0	0	0
chr1:8526083-8555123	0	0	0
chr1:8555222-8557465	0	0	0
chr1:8557589-8568686	0	0	0
chr1:8568734-8601273	0	0	0
chr1:8601377-8616534	0	0	0
chr1:8616630-8617477	0	0	0
chr1:8617582-8674620	0	0	0
chr1:8674745-8684369	0	0	0
chr1:8684439-8716032	0	0	0
chr1:8716500-8813490	0	0	0
chr1:8716500-8877219	0	0	0
chr1:8482867-8483621	0	0	0
chr1:8852647-8877219	0	0	0
chr1:8716500-8852463	0	0	0
chr1:8424898-8425872 chr1:8426034-8482787 chr1:8482867-8525985			
chr1:8415180-8415479	0	0	0
chr1:8415659-8416160	0	0	0
chr1:8416306-8418256	0	0	0
chr1:8418976-8419824	0	0	0
chr1:8420046-8420172	0	0	0
chr1:8421550-8421823	0	0	0
chr1:8421936-8422743	0	0	0
chr1:8422904-8424116	0	0	0
chr1:8424315-8424806	0	0	0
chr1:8424898-8425872	1	0	0
chr1:8426034-8482787	0	1	0
chr1:8482867-8525985	0	0	1
chr1:8526083-8555123	0	0	0
chr1:8555222-8557465	0	0	0
chr1:8557589-8568686	0	0	0
chr1:8568734-8601273	0	0	0
chr1:8601377-8616534	0	0	0
chr1:8616630-8617477	0	0	0
chr1:8617582-8674620	0	0	0
chr1:8674745-8684369	0	0	0
chr1:8684439-8716032	0	0	0
chr1:8716500-8813490	0	0	0
chr1:8716500-8877219	0	0	0
chr1:8482867-8483621	0	0	1
chr1:8852647-8877219	0	0	0

chr1:8716500-8852463	0	0	0
	chr1:8526083-8555123	chr1:8555222-8557465	chr1:8557589-8568686
chr1:8415180-8415479	0	0	0
chr1:8415659-8416160	0	0	0
chr1:8416306-8418256	0	0	0
chr1:8418976-8419824	0	0	0
chr1:8420046-8420172	0	0	0
chr1:8421550-8421823	0	0	0
chr1:8421936-8422743	0	0	0
chr1:8422904-8424116	0	0	0
chr1:8424315-8424806	0	0	0
chr1:8424898-8425872	0	0	0
chr1:8426034-8482787	0	0	0
chr1:8482867-8525985	0	0	0
chr1:8526083-8555123	1	0	0
chr1:8555222-8557465	0	1	0
chr1:8557589-8568686	0	0	1
chr1:8568734-8601273	0	0	0
chr1:8601377-8616534	0	0	0
chr1:8616630-8617477	0	0	0
chr1:8617582-8674620	0	0	0
chr1:8674745-8684369	0	0	0
chr1:8684439-8716032	0	0	0
chr1:8716500-8813490	0	0	0
chr1:8716500-8877219	0	0	0
chr1:8482867-8483621	0	0	0
chr1:8852647-8877219	0	0	0
chr1:8716500-8852463	0	0	0
	chr1:8568734-8601273	chr1:8601377-8616534	chr1:8616630-8617477
chr1:8415180-8415479	0	0	0
chr1:8415659-8416160	0	0	0
chr1:8416306-8418256	0	0	0
chr1:8418976-8419824	0	0	0
chr1:8420046-8420172	0	0	0
chr1:8421550-8421823	0	0	0
chr1:8421936-8422743	0	0	0
chr1:8422904-8424116	0	0	0
chr1:8424315-8424806	0	0	0
chr1:8424898-8425872	0	0	0
chr1:8426034-8482787	0	0	0
chr1:8482867-8525985	0	0	0
chr1:8526083-8555123	0	0	0
chr1:8555222-8557465	0	0	0
chr1:8557589-8568686	0	0	0
chr1:8568734-8601273	1	0	0
chr1:8601377-8616534	0	1	0
chr1:8616630-8617477	0	0	1
chr1:8617582-8674620	0	0	0
chr1:8674745-8684369	0	0	0
chr1:8684439-8716032	0	0	0
chr1:8716500-8813490	0	0	0

chr1:8716500-8877219	0	0	0
chr1:8482867-8483621	0	0	0
chr1:8852647-8877219	0	0	0
chr1:8716500-8852463	0	0	0
chr1:8415180-8415479	0	0	0
chr1:8415659-8416160	0	0	0
chr1:8416306-8418256	0	0	0
chr1:8418976-8419824	0	0	0
chr1:8420046-8420172	0	0	0
chr1:8421550-8421823	0	0	0
chr1:8421936-8422743	0	0	0
chr1:8422904-8424116	0	0	0
chr1:8424315-8424806	0	0	0
chr1:8424898-8425872	0	0	0
chr1:8426034-8482787	0	0	0
chr1:8482867-8525985	0	0	0
chr1:8526083-8555123	0	0	0
chr1:8555222-8557465	0	0	0
chr1:8557589-8568686	0	0	0
chr1:8568734-8601273	0	0	0
chr1:8601377-8616534	0	0	0
chr1:8616630-8617477	0	0	0
chr1:8617582-8674620	1	0	0
chr1:8674745-8684369	0	1	0
chr1:8684439-8716032	0	0	1
chr1:8716500-8813490	0	0	0
chr1:8716500-8877219	0	0	0
chr1:8482867-8483621	0	0	0
chr1:8852647-8877219	0	0	0
chr1:8716500-8852463	0	0	0
chr1:8415180-8415479	0	0	0
chr1:8415659-8416160	0	0	0
chr1:8416306-8418256	0	0	0
chr1:8418976-8419824	0	0	0
chr1:8420046-8420172	0	0	0
chr1:8421550-8421823	0	0	0
chr1:8421936-8422743	0	0	0
chr1:8422904-8424116	0	0	0
chr1:8424315-8424806	0	0	0
chr1:8424898-8425872	0	0	0
chr1:8426034-8482787	0	0	0
chr1:8482867-8525985	0	0	1
chr1:8526083-8555123	0	0	0
chr1:8555222-8557465	0	0	0
chr1:8557589-8568686	0	0	0
chr1:8568734-8601273	0	0	0
chr1:8601377-8616534	0	0	0
chr1:8616630-8617477	0	0	0
chr1:8617582-8674620	0	0	0

chr1:8674745-8684369	0	0	0
chr1:8684439-8716032	0	0	0
chr1:8716500-8813490	1	1	0
chr1:8716500-8877219	1	1	0
chr1:8482867-8483621	0	0	1
chr1:8852647-8877219	0	1	0
chr1:8716500-8852463	1	1	0
chr1:8852647-8877219 chr1:8716500-8852463			
chr1:8415180-8415479	0	0	
chr1:8415659-8416160	0	0	
chr1:8416306-8418256	0	0	
chr1:8418976-8419824	0	0	
chr1:8420046-8420172	0	0	
chr1:8421550-8421823	0	0	
chr1:8421936-8422743	0	0	
chr1:8422904-8424116	0	0	
chr1:8424315-8424806	0	0	
chr1:8424898-8425872	0	0	
chr1:8426034-8482787	0	0	
chr1:8482867-8525985	0	0	
chr1:8526083-8555123	0	0	
chr1:8555222-8557465	0	0	
chr1:8557589-8568686	0	0	
chr1:8568734-8601273	0	0	
chr1:8601377-8616534	0	0	
chr1:8616630-8617477	0	0	
chr1:8617582-8674620	0	0	
chr1:8674745-8684369	0	0	
chr1:8684439-8716032	0	0	
chr1:8716500-8813490	0	1	
chr1:8716500-8877219	1	1	
chr1:8482867-8483621	0	0	
chr1:8852647-8877219	1	0	
chr1:8716500-8852463	0	1	
\$Rest\$SLAMF7			
chr1:160709146-160717984 chr1:160709146-160719611			
chr1:160709146-160717984	1	1	
chr1:160709146-160719611	1	1	
chr1:160718304-160719611	0	1	
chr1:160719883-160720094	0	0	
chr1:160719922-160720094	0	0	
chr1:160720213-160721135	0	0	
chr1:160720213-160721976	0	0	
chr1:160721238-160721976	0	0	
chr1:160722038-160722896	0	0	
chr1:160718304-160719611 chr1:160719883-160720094			
chr1:160709146-160717984	0	0	
chr1:160709146-160719611	1	0	
chr1:160718304-160719611	1	0	
chr1:160719883-160720094	0	1	

chr1:160719922-160720094	0	1
chr1:160720213-160721135	0	0
chr1:160720213-160721976	0	0
chr1:160721238-160721976	0	0
chr1:160722038-160722896	0	0
chr1:160719922-160720094 chr1:160720213-160721135		
chr1:160709146-160717984	0	0
chr1:160709146-160719611	0	0
chr1:160718304-160719611	0	0
chr1:160719883-160720094	1	0
chr1:160719922-160720094	1	0
chr1:160720213-160721135	0	1
chr1:160720213-160721976	0	1
chr1:160721238-160721976	0	0
chr1:160722038-160722896	0	0
chr1:160720213-160721976 chr1:160721238-160721976		
chr1:160709146-160717984	0	0
chr1:160709146-160719611	0	0
chr1:160718304-160719611	0	0
chr1:160719883-160720094	0	0
chr1:160719922-160720094	0	0
chr1:160720213-160721135	1	0
chr1:160720213-160721976	1	1
chr1:160721238-160721976	1	1
chr1:160722038-160722896	0	0
chr1:160722038-160722896		
chr1:160709146-160717984	0	
chr1:160709146-160719611	0	
chr1:160718304-160719611	0	
chr1:160719883-160720094	0	
chr1:160719922-160720094	0	
chr1:160720213-160721135	0	
chr1:160720213-160721976	0	
chr1:160721238-160721976	0	
chr1:160722038-160722896	1	
\$Rest\$SLC41A1		
chr1:205760846-205763998 chr1:205764146-205764472		
chr1:205760846-205763998	1	0
chr1:205764146-205764472	0	1
chr1:205764606-205766052	0	0
chr1:205766131-205767032	0	0
chr1:205767179-205767797	0	0
chr1:205767943-205768085	0	0
chr1:205768229-205768887	0	0
chr1:205768958-205770081	0	0
chr1:205770188-205779198	0	0
chr1:205780215-205781936	0	0
chr1:205764606-205766052 chr1:205766131-205767032		
chr1:205760846-205763998	0	0
chr1:205764146-205764472	0	0

chr1:205764606-205766052	1	0
chr1:205766131-205767032	0	1
chr1:205767179-205767797	0	0
chr1:205767943-205768085	0	0
chr1:205768229-205768887	0	0
chr1:205768958-205770081	0	0
chr1:205770188-205779198	0	0
chr1:205780215-205781936	0	0
chr1:205767179-205767797 chr1:205767943-205768085		
chr1:205760846-205763998	0	0
chr1:205764146-205764472	0	0
chr1:205764606-205766052	0	0
chr1:205766131-205767032	0	0
chr1:205767179-205767797	1	0
chr1:205767943-205768085	0	1
chr1:205768229-205768887	0	0
chr1:205768958-205770081	0	0
chr1:205770188-205779198	0	0
chr1:205780215-205781936	0	0
chr1:205768229-205768887 chr1:205768958-205770081		
chr1:205760846-205763998	0	0
chr1:205764146-205764472	0	0
chr1:205764606-205766052	0	0
chr1:205766131-205767032	0	0
chr1:205767179-205767797	0	0
chr1:205767943-205768085	0	0
chr1:205768229-205768887	1	0
chr1:205768958-205770081	0	1
chr1:205770188-205779198	0	0
chr1:205780215-205781936	0	0
chr1:205770188-205779198 chr1:205780215-205781936		
chr1:205760846-205763998	0	0
chr1:205764146-205764472	0	0
chr1:205764606-205766052	0	0
chr1:205766131-205767032	0	0
chr1:205767179-205767797	0	0
chr1:205767943-205768085	0	0
chr1:205768229-205768887	0	0
chr1:205768958-205770081	0	0
chr1:205770188-205779198	1	0
chr1:205780215-205781936	0	1

\$Rest\$TFAP2E

chr1:36040299-36042923 chr1:36043093-36070834		
chr1:36040299-36042923	1	0
chr1:36043093-36070834	0	1

\$Rest\$TMEM51

chr1:15479280-15541391 chr1:15480450-15541391		
chr1:15479280-15541391	1	1
chr1:15480450-15541391	1	1

chr1:15541927-15545822	0	0
chr1:15480450-15536986	1	1
chr1:15537058-15541391	1	1
chr1:15479280-15541391	0	1
chr1:15480450-15541391	0	1
chr1:15541927-15545822	1	0
chr1:15480450-15536986	0	1
chr1:15537058-15541391	0	0
chr1:15479280-15541391	1	
chr1:15480450-15541391	1	
chr1:15541927-15545822	0	
chr1:15480450-15536986	0	
chr1:15537058-15541391	1	
\$Rest\$TMEM63A		
chr1:226034633-226034735	1	0
chr1:226034914-226036193	0	1
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0
chr1:226044439-226044611	0	0
chr1:226044717-226046896	0	0
chr1:226047049-226048560	0	0
chr1:226048697-226049918	0	0
chr1:226050051-226050155	0	0
chr1:226050278-226050471	0	0
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226036255-226036598		
chr1:226036713-226037613		
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	1	0
chr1:226036713-226037613	0	1
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0

chr1:226044439-226044611	0	0
chr1:226044717-226046896	0	0
chr1:226047049-226048560	0	0
chr1:226048697-226049918	0	0
chr1:226050051-226050155	0	0
chr1:226050278-226050471	0	0
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226037780-226040365 chr1:226040470-226041330		
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	1	0
chr1:226040470-226041330	0	1
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0
chr1:226044439-226044611	0	0
chr1:226044717-226046896	0	0
chr1:226047049-226048560	0	0
chr1:226048697-226049918	0	0
chr1:226050051-226050155	0	0
chr1:226050278-226050471	0	0
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226041492-226043579 chr1:226043641-226044353		
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	1	0
chr1:226043641-226044353	0	1
chr1:226044439-226044611	0	0

chr1:226044717-226046896	0	0
chr1:226047049-226048560	0	0
chr1:226048697-226049918	0	0
chr1:226050051-226050155	0	0
chr1:226050278-226050471	0	0
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226044439-226044611	chr1:226044717-226046896	
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0
chr1:226044439-226044611	1	0
chr1:226044717-226046896	0	1
chr1:226047049-226048560	0	0
chr1:226048697-226049918	0	0
chr1:226050051-226050155	0	0
chr1:226050278-226050471	0	0
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226047049-226048560	chr1:226048697-226049918	
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0
chr1:226044439-226044611	0	0
chr1:226044717-226046896	0	0

chr1:226047049-226048560	1	0
chr1:226048697-226049918	0	1
chr1:226050051-226050155	0	0
chr1:226050278-226050471	0	0
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226050051-226050155 chr1:226050278-226050471		
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0
chr1:226044439-226044611	0	0
chr1:226044717-226046896	0	0
chr1:226047049-226048560	0	0
chr1:226048697-226049918	0	0
chr1:226050051-226050155	1	0
chr1:226050278-226050471	0	1
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226050551-226053597 chr1:226053667-226054274		
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0
chr1:226044439-226044611	0	0
chr1:226044717-226046896	0	0
chr1:226047049-226048560	0	0

chr1:226048697-226049918	0	0
chr1:226050051-226050155	0	0
chr1:226050278-226050471	0	0
chr1:226050551-226053597	1	0
chr1:226053667-226054274	0	1
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226054382-226054812 chr1:226054863-226055588		
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0
chr1:226044439-226044611	0	0
chr1:226044717-226046896	0	0
chr1:226047049-226048560	0	0
chr1:226048697-226049918	0	0
chr1:226050051-226050155	0	0
chr1:226050278-226050471	0	0
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	1	0
chr1:226054863-226055588	0	1
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226055730-226058776 chr1:226058813-226059687		
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0
chr1:226044439-226044611	0	0
chr1:226044717-226046896	0	0
chr1:226047049-226048560	0	0
chr1:226048697-226049918	0	0

chr1:226050051-226050155	0	0
chr1:226050278-226050471	0	0
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	1	0
chr1:226058813-226059687	0	1
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226059753-226061988 chr1:226062067-226065095		
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0
chr1:226044439-226044611	0	0
chr1:226044717-226046896	0	0
chr1:226047049-226048560	0	0
chr1:226048697-226049918	0	0
chr1:226050051-226050155	0	0
chr1:226050278-226050471	0	0
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	1	0
chr1:226062067-226065095	0	1
chr1:226065294-226066920	0	0
chr1:226067110-226070004	0	0
chr1:226065294-226066920 chr1:226067110-226070004		
chr1:226034633-226034735	0	0
chr1:226034914-226036193	0	0
chr1:226036255-226036598	0	0
chr1:226036713-226037613	0	0
chr1:226037780-226040365	0	0
chr1:226040470-226041330	0	0
chr1:226041492-226043579	0	0
chr1:226043641-226044353	0	0
chr1:226044439-226044611	0	0
chr1:226044717-226046896	0	0
chr1:226047049-226048560	0	0
chr1:226048697-226049918	0	0
chr1:226050051-226050155	0	0

chr1:226050278-226050471	0	0
chr1:226050551-226053597	0	0
chr1:226053667-226054274	0	0
chr1:226054382-226054812	0	0
chr1:226054863-226055588	0	0
chr1:226055730-226058776	0	0
chr1:226058813-226059687	0	0
chr1:226059753-226061988	0	0
chr1:226062067-226065095	0	0
chr1:226065294-226066920	1	0
chr1:226067110-226070004	0	1

\$Rest\$TNFRSF1B

chr1:12227226-12248853		chr1:12248952-12251014
chr1:12227226-12248853	1	0
chr1:12248952-12251014	0	1
chr1:12251142-12251831	0	0
chr1:12251980-12252488	0	0
chr1:12252581-12252920	0	0
chr1:12253155-12254012	0	0
chr1:12254089-12254641	0	0
chr1:12254675-12262024	0	0
chr1:12262228-12266797	0	0
chr1:12227226-12251014	1	1
chr1:12251142-12251831		chr1:12251980-12252488
chr1:12227226-12248853	0	0
chr1:12248952-12251014	0	0
chr1:12251142-12251831	1	0
chr1:12251980-12252488	0	1
chr1:12252581-12252920	0	0
chr1:12253155-12254012	0	0
chr1:12254089-12254641	0	0
chr1:12254675-12262024	0	0
chr1:12262228-12266797	0	0
chr1:12227226-12251014	0	0
chr1:12252581-12252920		chr1:12253155-12254012
chr1:12227226-12248853	0	0
chr1:12248952-12251014	0	0
chr1:12251142-12251831	0	0
chr1:12251980-12252488	0	0
chr1:12252581-12252920	1	0
chr1:12253155-12254012	0	1
chr1:12254089-12254641	0	0
chr1:12254675-12262024	0	0
chr1:12262228-12266797	0	0
chr1:12227226-12251014	0	0
chr1:12254089-12254641		chr1:12254675-12262024
chr1:12227226-12248853	0	0
chr1:12248952-12251014	0	0
chr1:12251142-12251831	0	0
chr1:12251980-12252488	0	0

chr1:12252581-12252920	0	0
chr1:12253155-12254012	0	0
chr1:12254089-12254641	1	0
chr1:12254675-12262024	0	1
chr1:12262228-12266797	0	0
chr1:12227226-12251014	0	0
chr1:12262228-12266797 chr1:12227226-12251014		
chr1:12227226-12248853	0	1
chr1:12248952-12251014	0	1
chr1:12251142-12251831	0	0
chr1:12251980-12252488	0	0
chr1:12252581-12252920	0	0
chr1:12253155-12254012	0	0
chr1:12254089-12254641	0	0
chr1:12254675-12262024	0	0
chr1:12262228-12266797	1	0
chr1:12227226-12251014	0	1

\$Rest\$UQCRH

chr1:46769492-46774773 chr1:46774799-46775827		
chr1:46769492-46774773	1	0
chr1:46774799-46775827	0	1
chr1:46775716-46775827	0	1
chr1:46775988-46782224	0	0
chr1:46774799-46775569	0	1
chr1:46775716-46775827 chr1:46775988-46782224		
chr1:46769492-46774773	0	0
chr1:46774799-46775827	1	0
chr1:46775716-46775827	1	0
chr1:46775988-46782224	0	1
chr1:46774799-46775569	0	0
chr1:46774799-46775569		
chr1:46769492-46774773	0	
chr1:46774799-46775827	1	
chr1:46775716-46775827	0	
chr1:46775988-46782224	0	
chr1:46774799-46775569	1	

\$genesJunction

\$genesJunction\$CMPK1

[1] "chr1:47799788-47834141" "chr1:47834287-47838627" "chr1:47838779-47840581"
 [4] "chr1:47838779-47840869" "chr1:47840657-47840869" "chr1:47840965-47842376"

\$genesJunction\$CSF1

[1] "chr1:110453684-110456881" "chr1:110457003-110458256" "chr1:110458318-110459915"
 [4] "chr1:110460085-110464469" "chr1:110464616-110465788" "chr1:110464616-110466682"
 [7] "chr1:110466812-110467398" "chr1:110467450-110467769" "chr1:110467824-110468685"
 [10] "chr1:110467824-110471474"

\$genesJunction\$FAM72B

```

[1] "chr1:120839865-120841975" "chr1:120839985-120841975" "chr1:120842052-120845995"
[4] "chr1:120846119-120854492"

$genesJunction$KLHL12
[1] "chr1:202861787-202862367" "chr1:202861787-202863312" "chr1:202862553-202863312"
[4] "chr1:202863410-202863719" "chr1:202863877-202864650" "chr1:202863877-202878138"
[7] "chr1:202864845-202865982" "chr1:202866088-202878138" "chr1:202878252-202880182"
[10] "chr1:202880331-202887299" "chr1:202887516-202888883" "chr1:202889036-202894096"
[13] "chr1:202894335-202896217"

$genesJunction$KLHL21
[1] "chr1:6653718-6655545" "chr1:6655617-6659107" "chr1:6659512-6659810"
[4] "chr1:6659512-6661857"

$genesJunction$MIR4632
[1] "chr1:12251142-12251831"

$genesJunction$MYSM1
[1] "chr1:59125827-59126842" "chr1:59126899-59127078" "chr1:59127183-59131171"
[4] "chr1:59131303-59132710" "chr1:59132898-59133519" "chr1:59133593-59134102"
[7] "chr1:59133593-59134304" "chr1:59134238-59134656" "chr1:59134354-59134656"
[10] "chr1:59134710-59137542" "chr1:59137630-59139245" "chr1:59139322-59141149"
[13] "chr1:59141252-59142598" "chr1:59142728-59147457" "chr1:59148217-59150825"
[16] "chr1:59150923-59154710" "chr1:59154788-59155898" "chr1:59155921-59156012"
[19] "chr1:59156089-59158533" "chr1:59158603-59160801" "chr1:59160879-59165657"

$genesJunction$NPHP4
[1] "chr1:5923465-5923950" "chr1:5924093-5924398" "chr1:5924577-5925162"
[4] "chr1:5925333-5926433" "chr1:5926518-5927090" "chr1:5927175-5927800"
[7] "chr1:5927956-5933312" "chr1:5933395-5934531" "chr1:5937358-5940174"
[10] "chr1:5940299-5947346" "chr1:5947526-5950928" "chr1:5951088-5964677"
[13] "chr1:5964864-5965352" "chr1:5965543-5965692" "chr1:5965843-5967175"
[16] "chr1:5967282-5969212" "chr1:5969273-5987709" "chr1:5987847-5993207"
[19] "chr1:5993389-6007164" "chr1:6007290-6008130" "chr1:6008311-6012760"
[22] "chr1:6012896-6021854" "chr1:6022009-6027359" "chr1:6027423-6029147"
[25] "chr1:6029319-6038330" "chr1:6038473-6046215" "chr1:6046387-6052304"
[28] "chr1:5934717-5934934" "chr1:5965840-5967175" "chr1:5936583-5937153"
[31] "chr1:5937358-5939406" "chr1:5939692-5940174"

$genesJunction$PEX14
[1] "chr1:10637247-10637871" "chr1:10659423-10678389" "chr1:10678474-10683076"
[4] "chr1:10683178-10684397" "chr1:10684494-10687329" "chr1:10687420-10689588"
[7] "chr1:10596354-10659295" "chr1:10596354-10678389"

$genesJunction$PIP5K1A
[1] "chr1:151171557-151196721" "chr1:151171557-151196724" "chr1:151196755-151199796"
[4] "chr1:151199876-151204147" "chr1:151204277-151204724" "chr1:151204841-151205027"
[7] "chr1:151205179-151206673" "chr1:151206972-151209034" "chr1:151209239-151210658"
[10] "chr1:151209239-151211606" "chr1:151210741-151211606" "chr1:151211654-151212431"
[13] "chr1:151212515-151214599" "chr1:151212515-151219396" "chr1:151214745-151214914"
[16] "chr1:151215043-151219396" "chr1:151219441-151220339" "chr1:151196755-151196847"

```

[19] "chr1:151196882-151199796" "chr1:151212515-151214914"

\$genesJunction\$PSMB2

[1] "chr1:36040299-36042923" "chr1:36068975-36070834" "chr1:36070883-36074847"
[4] "chr1:36075009-36096875" "chr1:36096945-36101911" "chr1:36102033-36106943"
[7] "chr1:36043093-36070834"

\$genesJunction\$RBBP4

[1] "chr1:33116923-33117515" "chr1:33117662-33123028" "chr1:33123173-33133826"
[4] "chr1:33133999-33134340" "chr1:33134455-33134573" "chr1:33134733-33134832"
[7] "chr1:33134958-33135087" "chr1:33135164-33138051" "chr1:33138127-33138243"
[10] "chr1:33138300-33138392" "chr1:33138502-33145241" "chr1:33116923-33117518"

\$genesJunction\$RBBP5

[1] "chr1:205057943-205064001" "chr1:205057943-205064115" "chr1:205064192-205065810"
[4] "chr1:205066039-205066454" "chr1:205066523-205068117" "chr1:205068234-205068869"
[7] "chr1:205068940-205069039" "chr1:205069192-205069280" "chr1:205069399-205070728"
[10] "chr1:205070837-205072985" "chr1:205073147-205074156" "chr1:205074296-205083917"
[13] "chr1:205084033-205084986" "chr1:205084089-205084986" "chr1:205085011-205090983"
[16] "chr1:205057940-205064001"

\$genesJunction\$RERE

[1] "chr1:8415180-8415479" "chr1:8415659-8416160" "chr1:8416306-8418256"
[4] "chr1:8418976-8419824" "chr1:8420046-8420172" "chr1:8421550-8421823"
[7] "chr1:8421936-8422743" "chr1:8422904-8424116" "chr1:8424315-8424806"
[10] "chr1:8424898-8425872" "chr1:8426034-8482787" "chr1:8482867-8525985"
[13] "chr1:8526083-8555123" "chr1:8555222-8557465" "chr1:8557589-8568686"
[16] "chr1:8568734-8601273" "chr1:8601377-8616534" "chr1:8616630-8617477"
[19] "chr1:8617582-8674620" "chr1:8674745-8684369" "chr1:8684439-8716032"
[22] "chr1:8716500-8813490" "chr1:8716500-8877219" "chr1:8482867-8483621"
[25] "chr1:8852647-8877219" "chr1:8716500-8852463"

\$genesJunction\$SLAMF7

[1] "chr1:160709146-160717984" "chr1:160709146-160719611" "chr1:160718304-160719611"
[4] "chr1:160719883-160720094" "chr1:160719922-160720094" "chr1:160720213-160721135"
[7] "chr1:160720213-160721976" "chr1:160721238-160721976" "chr1:160722038-160722896"

\$genesJunction\$SLC41A1

[1] "chr1:205760846-205763998" "chr1:205764146-205764472" "chr1:205764606-205766052"
[4] "chr1:205766131-205767032" "chr1:205767179-205767797" "chr1:205767943-205768085"
[7] "chr1:205768229-205768887" "chr1:205768958-205770081" "chr1:205770188-205779198"
[10] "chr1:205780215-205781936"

\$genesJunction\$TFAP2E

[1] "chr1:36040299-36042923" "chr1:36043093-36070834"

\$genesJunction\$TMEM51

[1] "chr1:15479280-15541391" "chr1:15480450-15541391" "chr1:15541927-15545822"
[4] "chr1:15480450-15536986" "chr1:15537058-15541391"

\$genesJunction\$TMEM63A

```

[1] "chr1:226034633-226034735" "chr1:226034914-226036193" "chr1:226036255-226036598"
[4] "chr1:226036713-226037613" "chr1:226037780-226040365" "chr1:226040470-226041330"
[7] "chr1:226041492-226043579" "chr1:226043641-226044353" "chr1:226044439-226044611"
[10] "chr1:226044717-226046896" "chr1:226047049-226048560" "chr1:226048697-226049918"
[13] "chr1:226050051-226050155" "chr1:226050278-226050471" "chr1:226050551-226053597"
[16] "chr1:226053667-226054274" "chr1:226054382-226054812" "chr1:226054863-226055588"
[19] "chr1:226055730-226058776" "chr1:226058813-226059687" "chr1:226059753-226061988"
[22] "chr1:226062067-226065095" "chr1:226065294-226066920" "chr1:226067110-226070004"

```

\$genesJunction\$TNFRSF1B

```

[1] "chr1:12227226-12248853" "chr1:12248952-12251014" "chr1:12251142-12251831"
[4] "chr1:12251980-12252488" "chr1:12252581-12252920" "chr1:12253155-12254012"
[7] "chr1:12254089-12254641" "chr1:12254675-12262024" "chr1:12262228-12266797"
[10] "chr1:12227226-12251014"

```

\$genesJunction\$UQCRH

```

[1] "chr1:46769492-46774773" "chr1:46774799-46775827" "chr1:46775716-46775827"
[4] "chr1:46775988-46782224" "chr1:46774799-46775569"

```

\$juncexpressed

```

[1] "chr1:47799788-47834141" "chr1:47834287-47838627"
[3] "chr1:47838779-47840581" "chr1:47838779-47840869"
[5] "chr1:47840657-47840869" "chr1:47840965-47842376"
[7] "chr1:110453684-110456881" "chr1:110457003-110458256"
[9] "chr1:110458318-110459915" "chr1:110460085-110464469"
[11] "chr1:110464616-110465788" "chr1:110464616-110466682"
[13] "chr1:110466812-110467398" "chr1:110467450-110467769"
[15] "chr1:110467824-110468685" "chr1:110467824-110471474"
[17] "chr1:120839865-120841975" "chr1:120839985-120841975"
[19] "chr1:120842052-120845995" "chr1:120846119-120854492"
[21] "chr1:202861787-202862367" "chr1:202861787-202863312"
[23] "chr1:202862553-202863312" "chr1:202863410-202863719"
[25] "chr1:202863877-202864650" "chr1:202863877-202878138"
[27] "chr1:202864845-202865982" "chr1:202866088-202878138"
[29] "chr1:202878252-202880182" "chr1:202880331-202887299"
[31] "chr1:202887516-202888883" "chr1:202889036-202894096"
[33] "chr1:202894335-202896217" "chr1:6653718-6655545"
[35] "chr1:6655617-6659107" "chr1:6659512-6659810"
[37] "chr1:6659512-6661857" "chr1:59125827-59126842"
[39] "chr1:59126899-59127078" "chr1:59127183-59131171"
[41] "chr1:59131303-59132710" "chr1:59132898-59133519"
[43] "chr1:59133593-59134102" "chr1:59133593-59134304"
[45] "chr1:59134238-59134656" "chr1:59134354-59134656"
[47] "chr1:59134710-59137542" "chr1:59137630-59139245"
[49] "chr1:59139322-59141149" "chr1:59141252-59142598"
[51] "chr1:59142728-59147457" "chr1:59148217-59150825"
[53] "chr1:59150923-59154710" "chr1:59154788-59155898"
[55] "chr1:59155921-59156012" "chr1:59156089-59158533"
[57] "chr1:59158603-59160801" "chr1:59160879-59165657"
[59] "chr1:5923465-5923950" "chr1:5924093-5924398"

```

[61]	"chr1:5924577-5925162"	"chr1:5925333-5926433"
[63]	"chr1:5926518-5927090"	"chr1:5927175-5927800"
[65]	"chr1:5927956-5933312"	"chr1:5933395-5934531"
[67]	"chr1:5937358-5940174"	"chr1:5940299-5947346"
[69]	"chr1:5947526-5950928"	"chr1:5951088-5964677"
[71]	"chr1:5964864-5965352"	"chr1:5965543-5965692"
[73]	"chr1:5965843-5967175"	"chr1:5967282-5969212"
[75]	"chr1:5969273-5987709"	"chr1:5987847-5993207"
[77]	"chr1:5993389-6007164"	"chr1:6007290-6008130"
[79]	"chr1:6008311-6012760"	"chr1:6012896-6021854"
[81]	"chr1:6022009-6027359"	"chr1:6027423-6029147"
[83]	"chr1:6029319-6038330"	"chr1:6038473-6046215"
[85]	"chr1:6046387-6052304"	"chr1:5934717-5934934"
[87]	"chr1:5965840-5967175"	"chr1:5936583-5937153"
[89]	"chr1:5937358-5939406"	"chr1:5939692-5940174"
[91]	"chr1:10637247-10637871"	"chr1:10659423-10678389"
[93]	"chr1:10678474-10683076"	"chr1:10683178-10684397"
[95]	"chr1:10684494-10687329"	"chr1:10687420-10689588"
[97]	"chr1:10596354-10659295"	"chr1:10596354-10678389"
[99]	"chr1:151171557-151196721"	"chr1:151171557-151196724"
[101]	"chr1:151196755-151199796"	"chr1:151199876-151204147"
[103]	"chr1:151204277-151204724"	"chr1:151204841-151205027"
[105]	"chr1:151205179-151206673"	"chr1:151206972-151209034"
[107]	"chr1:151209239-151210658"	"chr1:151209239-151211606"
[109]	"chr1:151210741-151211606"	"chr1:151211654-151212431"
[111]	"chr1:151212515-151214599"	"chr1:151212515-151219396"
[113]	"chr1:151214745-151214914"	"chr1:151215043-151219396"
[115]	"chr1:151219441-151220339"	"chr1:151196755-151196847"
[117]	"chr1:151196882-151199796"	"chr1:151212515-151214914"
[119]	"chr1:36040299-36042923"	"chr1:36068975-36070834"
[121]	"chr1:36070883-36074847"	"chr1:36075009-36096875"
[123]	"chr1:36096945-36101911"	"chr1:36102033-36106943"
[125]	"chr1:36043093-36070834"	"chr1:33116923-33117515"
[127]	"chr1:33117662-33123028"	"chr1:33123173-33133826"
[129]	"chr1:33133999-33134340"	"chr1:33134455-33134573"
[131]	"chr1:33134733-33134832"	"chr1:33134958-33135087"
[133]	"chr1:33135164-33138051"	"chr1:33138127-33138243"
[135]	"chr1:33138300-33138392"	"chr1:33138502-33145241"
[137]	"chr1:33116923-33117518"	"chr1:205057943-205064001"
[139]	"chr1:205057943-205064115"	"chr1:205064192-205065810"
[141]	"chr1:205066039-205066454"	"chr1:205066523-205068117"
[143]	"chr1:205068234-205068869"	"chr1:205068940-205069039"
[145]	"chr1:205069192-205069280"	"chr1:205069399-205070728"
[147]	"chr1:205070837-205072985"	"chr1:205073147-205074156"
[149]	"chr1:205074296-205083917"	"chr1:205084033-205084986"
[151]	"chr1:205084089-205084986"	"chr1:205085011-205090983"
[153]	"chr1:205057940-205064001"	"chr1:8415180-8415479"
[155]	"chr1:8415659-8416160"	"chr1:8416306-8418256"
[157]	"chr1:8418976-8419824"	"chr1:8420046-8420172"
[159]	"chr1:8421550-8421823"	"chr1:8421936-8422743"
[161]	"chr1:8422904-8424116"	"chr1:8424315-8424806"

```

[163] "chr1:8424898-8425872"      "chr1:8426034-8482787"
[165] "chr1:8482867-8525985"      "chr1:8526083-8555123"
[167] "chr1:8555222-8557465"      "chr1:8557589-8568686"
[169] "chr1:8568734-8601273"      "chr1:8601377-8616534"
[171] "chr1:8616630-8617477"      "chr1:8617582-8674620"
[173] "chr1:8674745-8684369"      "chr1:8684439-8716032"
[175] "chr1:8716500-8813490"      "chr1:8716500-8877219"
[177] "chr1:8482867-8483621"      "chr1:8852647-8877219"
[179] "chr1:8716500-8852463"      "chr1:160709146-160717984"
[181] "chr1:160709146-160719611"  "chr1:160718304-160719611"
[183] "chr1:160719883-160720094"  "chr1:160719922-160720094"
[185] "chr1:160720213-160721135"  "chr1:160720213-160721976"
[187] "chr1:160721238-160721976"  "chr1:160722038-160722896"
[189] "chr1:205760846-205763998"  "chr1:205764146-205764472"
[191] "chr1:205764606-205766052"  "chr1:205766131-205767032"
[193] "chr1:205767179-205767797"  "chr1:205767943-205768085"
[195] "chr1:205768229-205768887"  "chr1:205768958-205770081"
[197] "chr1:205770188-205779198"  "chr1:205780215-205781936"
[199] "chr1:15479280-15541391"    "chr1:15480450-15541391"
[201] "chr1:15541927-15545822"    "chr1:15480450-15536986"
[203] "chr1:15537058-15541391"    "chr1:226034633-226034735"
[205] "chr1:226034914-226036193"  "chr1:226036255-226036598"
[207] "chr1:226036713-226037613"  "chr1:226037780-226040365"
[209] "chr1:226040470-226041330"  "chr1:226041492-226043579"
[211] "chr1:226043641-226044353"  "chr1:226044439-226044611"
[213] "chr1:226044717-226046896"  "chr1:226047049-226048560"
[215] "chr1:226048697-226049918"  "chr1:226050051-226050155"
[217] "chr1:226050278-226050471"  "chr1:226050551-226053597"
[219] "chr1:226053667-226054274"  "chr1:226054382-226054812"
[221] "chr1:226054863-226055588"  "chr1:226055730-226058776"
[223] "chr1:226058813-226059687"  "chr1:226059753-226061988"
[225] "chr1:226062067-226065095"  "chr1:226065294-226066920"
[227] "chr1:226067110-226070004"  "chr1:12227226-12248853"
[229] "chr1:12248952-12251014"    "chr1:12251142-12251831"
[231] "chr1:12251980-12252488"    "chr1:12252581-12252920"
[233] "chr1:12253155-12254012"    "chr1:12254089-12254641"
[235] "chr1:12254675-12262024"    "chr1:12262228-12266797"
[237] "chr1:12227226-12251014"    "chr1:46769492-46774773"
[239] "chr1:46774799-46775827"    "chr1:46775716-46775827"
[241] "chr1:46775988-46782224"    "chr1:46774799-46775569"

```

```
> print(overlapMat[["Rest"]][["CMPK1"]])
```

```

chr1:47799788-47834141 chr1:47834287-47838627
chr1:47799788-47834141      1      0
chr1:47834287-47838627      0      1
chr1:47838779-47840581      0      0
chr1:47838779-47840869      0      0
chr1:47840657-47840869      0      0
chr1:47840965-47842376      0      0
chr1:47838779-47840581 chr1:47838779-47840869
chr1:47799788-47834141      0      0

```

```

chr1:47834287-47838627      0      0
chr1:47838779-47840581      1      1
chr1:47838779-47840869      1      1
chr1:47840657-47840869      0      1
chr1:47840965-47842376      0      0
chr1:47840657-47840869 chr1:47840965-47842376
chr1:47799788-47834141      0      0
chr1:47834287-47838627      0      0
chr1:47838779-47840581      0      0
chr1:47838779-47840869      1      0
chr1:47840657-47840869      1      0
chr1:47840965-47842376      0      1
chr1:47799788-47834141 chr1:47834287-47838627
chr1:47799788-47834141      1      0
chr1:47834287-47838627      0      1
chr1:47838779-47840581      0      0
chr1:47838779-47840869      0      0
chr1:47840657-47840869      0      0
chr1:47840965-47842376      0      0
chr1:47838779-47840581 chr1:47838779-47840869
chr1:47799788-47834141      0      0
chr1:47834287-47838627      0      0
chr1:47838779-47840581      1      1
chr1:47838779-47840869      1      1
chr1:47840657-47840869      0      1
chr1:47840965-47842376      0      0
chr1:47840657-47840869 chr1:47840965-47842376
chr1:47799788-47834141      0      0
chr1:47834287-47838627      0      0
chr1:47838779-47840581      0      0
chr1:47838779-47840869      1      0
chr1:47840657-47840869      1      0
chr1:47840965-47842376      0      1

```

>

Another important function is kendall- τ restricted.

```

> V <- cbind(c(1,5,3),c(3,2,1))
      [,1] [,2]
[1,]    1    3
[2,]    5    2
[3,]    3    1

> rownames(V) <- c("F1","F2","F3")
[1] "F1" "F2" "F3"

> colnames(V) <- c("S1","S2")
[1] "S1" "S2"

```



```

> GSReg.kendall1.tau.distance(V)

      S1      S2
S1 0.0000000 0.6666667
S2 0.6666667 0.0000000

> myRest1 <- cbind(c(0,1,1),c(1,0,1),c(1,1,0))

      [,1] [,2] [,3]
[1,]    0    1    1
[2,]    1    0    1
[3,]    1    1    0

> rownames(myRest1) <- rownames(V)

[1] "F1" "F2" "F3"

> colnames(myRest1) <- rownames(V)

[1] "F1" "F2" "F3"

> GSReg.kendall1.tau.distance.restricted(V,myRest1)

      S1      S2
S1 0.0000000 0.6666666
S2 0.6666666 0.0000000

> GSReg.kendall1.tau.distance(V)

      S1      S2
S1 0.0000000 0.6666667
S2 0.6666667 0.0000000

> myRest2 <- cbind(c(0,0,1),c(0,0,1),c(1,1,0))

      [,1] [,2] [,3]
[1,]    0    0    1
[2,]    0    0    1
[3,]    1    1    0

> rownames(myRest2) <- rownames(V)

[1] "F1" "F2" "F3"

> colnames(myRest2) <- rownames(V)

[1] "F1" "F2" "F3"

> GSReg.kendall1.tau.distance.restricted(V,myRest2)

      S1      S2
S1 0.0000000 0.4999999
S2 0.4999999 0.0000000

> Temp1 <- cbind(c(0,1,1),c(0,0,0),c(0,1,0))

```

```

      [,1] [,2] [,3]
[1,]    0    0    0
[2,]    1    0    1
[3,]    1    0    0

> rownames(Temp1) <- rownames(V)

[1] "F1" "F2" "F3"

> colnames(Temp1) <- rownames(V)

[1] "F1" "F2" "F3"

> GSReg.kendall.tau.distance.template(V,Temp = Temp1)

      S1      S2
1.0000000 0.3333333

```

Now, we can use SEVA function and use the data from the paper [?].

```

> data(juncExprsSimulated)
> SEVAjunc <- GSReg.SEVA(juncExprs = junc.RPM.Simulated,
                        phenoVect = phenotypes,
                        geneexpr = geneExprsGSReg)
> print(sapply(SEVAjunc,function(x) x$pvalue))

      CMPK1      CSF1      FAM72B      KLHL12      KLHL21      MYSM1      NPHP4
1.00000000 1.00000000 0.00000000 0.00000000 0.19089848 0.00000000 0.53048443
      PEX14      PIP5K1A      PSMB2      RBBP4      RBBP5      RERE      SLAMF7
0.81734872 0.00000000 1.00000000 0.00000000 0.07123363 0.29801755 0.00000000
      SLC41A1      TMEM51      TMEM63A      TNFRSF1B      UQCRH
1.00000000 0.09424228 1.00000000 1.00000000 0.00000000

> #if you want to check Translational as well you can use 2 other p-values
> print(sapply(SEVAjunc,function(x) x$pvalueTotal))

      CMPK1      CSF1      FAM72B      KLHL12      KLHL21      MYSM1      NPHP4
1.00000000 1.00000000 0.00000000 0.00000000 0.26032517 0.00000000 1.00000000
      PEX14      PIP5K1A      PSMB2      RBBP4      RBBP5      RERE      SLAMF7
1.00000000 0.00000000 1.00000000 0.00000000 0.02343778 0.89405265 0.00000000
      SLC41A1      TMEM51      TMEM63A      TNFRSF1B      UQCRH
1.00000000 0.17473402 1.00000000 1.00000000 0.00000000

>

```

4 System Information

Session information:

```
> toLatex(sessionInfo())
```

- R version 3.4.0 (2017-04-21), x86_64-apple-darwin15.6.0
- Locale: C/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
- Running under: OS X El Capitan 10.11.6
- Matrix products: default
- BLAS:
/Library/Frameworks/R.framework/Versions/3.4/Resources/lib/libRblas.0.dylib
- LAPACK:
/Library/Frameworks/R.framework/Versions/3.4/Resources/lib/libRlapack.dylib
- Base packages: base, datasets, grDevices, graphics, methods, parallel, stats, stats4, utils
- Other packages: AnnotationDbi 1.38.0, Biobase 2.36.0, BiocGenerics 0.22.0, GO.db 3.4.1, GSBenchmark 0.109.2, GSReg 1.10.0, GenomeInfoDb 1.12.0, GenomicFeatures 1.28.0, GenomicRanges 1.28.0, Homo.sapiens 1.3.1, IRanges 2.10.0, OrganismDbi 1.18.0, S4Vectors 0.14.0, TxDb.Hsapiens.UCSC.hg19.knownGene 3.2.2, org.Hs.eg.db 3.4.1
- Loaded via a namespace (and not attached): BiocInstaller 1.26.0, BiocParallel 1.10.0, Biostrings 2.44.0, DBI 0.6-1, DelayedArray 0.2.0, GenomeInfoDbData 0.99.0, GenomicAlignments 1.12.0, Matrix 1.2-9, RBGL 1.52.0, RCurl 1.95-4.8, RSQLite 1.1-2, Rcpp 0.12.10, Rsamtools 1.28.0, SummarizedExperiment 1.6.0, XML 3.98-1.6, XVector 0.16.0, biomaRt 2.32.0, bitops 1.0-6, compiler 3.4.0, digest 0.6.12, graph 1.54.0, grid 3.4.0, lattice 0.20-35, matrixStats 0.52.2, memoise 1.1.0, rtracklayer 1.36.0, tools 3.4.0, zlibbioc 1.22.0

5 Literature Cited

References

- [1] James A Eddy, Leroy Hood, Nathan D Price, and Donald Geman. Identifying tightly regulated and variably expressed networks by differential rank conservation (dirac). *PLoS computational biology*, 6(5):e1000792, 2010.

- [2] Bahman Afsari. *Modeling cancer phenotypes with order statistics of transcript data*. PhD thesis, Johns Hopkins University, 2013.
- [3] Maurice G Kendall. A new measure of rank correlation. *Biometrika*, 1938.