Distinct patterns for zeroes in Euler diagrams on three sets

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This vignette does not need to be read to understand the Vennerable package.

The Euler diagram on three sets has seven regions which are not dark matter. If the weight associated to the region is zero, we do not want to display the region. The number of possible patterns of zeros is $2^7 = 128$ but many of these patterns are symmetric under a relabelling of the original sets.

How many distinct zero-patterns are there, allowing set relabelling?

```
> library(Vennerable)
> library(xtable)
> library(grid)
> Eclass <-Vennerable::: EulerClasses(n=3)
> Ehave3 <- subset(Eclass,SetsRepresented==3 , -SetsRepresented)
> Ehave <- subset(Eclass, ESignature==ESignatureCanonical,-ESignatureCanonical)
>
```

There are 40 patterns with all sets represented

```
> print(xtable(Ehave,digits=0),size="small"
+ )
```

```
> E3List <- lapply(Ehave3$ESignature,function(VS){
+         Weights <- t(Ehave3[Ehave3$ESignature==VS,2:8])[,1]
+         Weights["000"] <- 0
+         Weights <- Weights[order(names(Weights))]
+         Weights
+ })
> names(E3List) <- Ehave3$ESignature
> V3List <- list()
> efails <- lapply(names(E3List),function(x) {
+         V <- Venn(Weight=E3List[[x]],SetNames=LETTERS[1:3])
+         res <- try(compute.Venn(V))
+         V3List[[x]] <<- res
+         return (inherits(res,"try-error"))
+         })
> names(efails) <- names(E3List)
> sho <- function(enames) {
+   #if (efails[[ename]]) { cat("I");return()}
```

```
+   grid.newpage()
+   pushViewport(viewport(layout=grid.layout(10,11)))
+   for(i in 1:11) { for (j in 1:10) {
+     #cat (i, " ", j,"\n")
+     ix = (i-1)*10+(j-1)+1;
+     if (ix>length(enames)){return()};
+     ename <- enames[[ ix]];
+     pushViewport(viewport(layout.pos.col=i,layout.pos.row=j))
+     if(!efails[[ename]]){
+     plot(V3List[[ename]],
+         show=list(Universe=FALSE,FaceText="",SetLabels=FALSE,Faces=FALSE))
+     }
+     popViewport()
+   #grid.text(ename)
+   }}
+ }
>
```

```
> sho(enames=names(E3List))
```

```
NULL
```

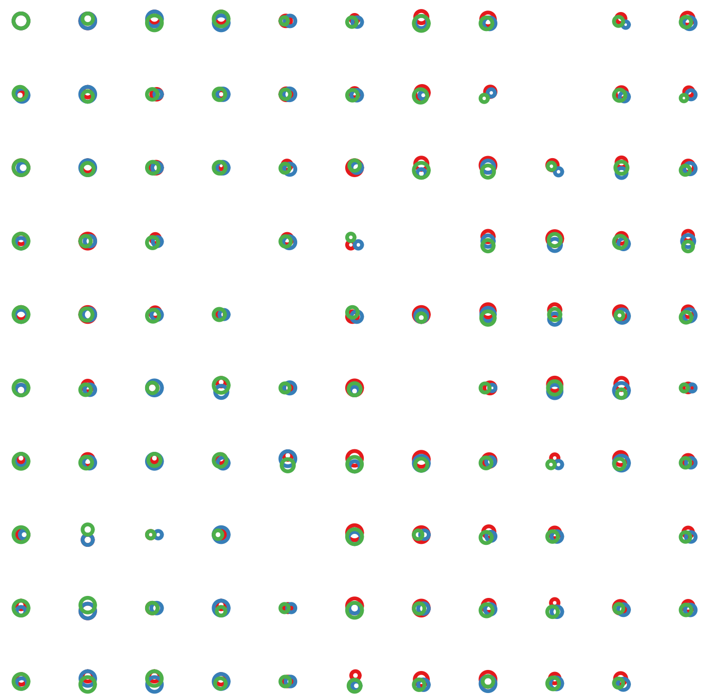

Figure 1: Lots of 3 sets

[1]

References

[1] A. W. F. Edwards. *Cogwheels of the Mind: The Story of Venn Diagrams*. The John Hopkins University Press, Baltimore, Maryland, 2004.

	ESignature	100	010	110	001	101	011	111	SetsRepresented
1	0000000	0	0	0	0	0	0	0	0
2	0000001	0	0	0	0	0	0	1	3
3	0000010	0	0	0	0	0	1	0	2
4	0000011	0	0	0	0	0	1	1	3
7	0000110	0	0	0	0	1	1	0	3
8	0000111	0	0	0	0	1	1	1	3
9	0001000	0	0	0	1	0	0	0	1
10	0001001	0	0	0	1	0	0	1	3
11	0001010	0	0	0	1	0	1	0	2
12	0001011	0	0	0	1	0	1	1	3
15	0001110	0	0	0	1	1	1	0	3
16	0001111	0	0	0	1	1	1	1	3
23	0010110	0	0	1	0	1	1	0	3
24	0010111	0	0	1	0	1	1	1	3
25	0011000	0	0	1	1	0	0	0	3
26	0011001	0	0	1	1	0	0	1	3
27	0011010	0	0	1	1	0	1	0	3
28	0011011	0	0	1	1	0	1	1	3
31	0011110	0	0	1	1	1	1	0	3
32	0011111	0	0	1	1	1	1	1	3
41	0101000	0	1	0	1	0	0	0	2
42	0101001	0	1	0	1	0	0	1	3
43	0101010	0	1	0	1	0	1	0	2
44	0101011	0	1	0	1	0	1	1	3
45	0101100	0	1	0	1	1	0	0	3
46	0101101	0	1	0	1	1	0	1	3
47	0101110	0	1	0	1	1	1	0	3
48	0101111	0	1	0	1	1	1	1	3
61	0111100	0	1	1	1	1	0	0	3
62	0111101	0	1	1	1	1	0	1	3
63	0111110	0	1	1	1	1	1	0	3
64	0111111	0	1	1	1	1	1	1	3
105	1101000	1	1	0	1	0	0	0	3
106	1101001	1	1	0	1	0	0	1	3
107	1101010	1	1	0	1	0	1	0	3
108	1101011	1	1	0	1	0	1	1	3
111	1101110	1	1	0	1	1	1	0	3
112	1101111	1	1	0	1	1	1	1	3
127	1111110	1	1	1	1	1	1	0	3
128	1111111	1	1	1	1	1	1	1	3