experiment 3

1.

```
d25 <- conf.design(rbind(c(A = 1, B = 1, C = 1, D = 0, E = 0),
                         c(A = 1, B = 0, C = 0, D = 1, E = 1)), p = 2)

d25

d25 <-d25 %>% mutate(e1=ifelse(A==1,"a",""),
                     e2=ifelse(B==1,"b",""),
                     e3=ifelse(C==1,"c",""),
                     e4=ifelse(D==1,"d",""),
                     e5=ifelse(E==1,"e",""),
                     effect=paste(e1,e2,e3,e4,e5, sep="")) %>% select(-c(e1,e2,e3,e4,e5))
d25
```

	Blocks	A	B	C	D	E	effect
1	00	0	0	0	0	0	
2	00	0	1	1	0	0	bc
3	00	1	1	0	1	0	abd
4	00	1	0	1	1	0	acd
5	00	1	1	0	0	1	abe
6	00	1	0	1	0	1	ace
7	00	0	0	0	1	1	de
8	00	0	1	1	1	1	bcde
9	01	1	1	0	0	0	ab
10	01	1	0	1	0	0	ac
11	01	0	0	0	1	0	d
12	01	0	1	1	1	0	bcd
13	01	0	0	0	0	1	e
14	01	0	1	1	0	1	bce
15	01	1	1	0	1	1	abde
16	01	1	0	1	1	1	acde
17	10	0	1	0	0	0	b
18	10	0	0	1	0	0	c
19	10	1	0	0	1	0	ad
20	10	1	1	1	1	0	abcd
21	10	1	0	0	0	1	ae
22	10	1	1	1	0	1	abce
23	10	0	1	0	1	1	bde
24	10	0	0	1	1	1	cde
25	11	1	0	0	0	0	a
26	11	1	1	1	0	0	abc
27	11	0	1	0	1	0	bd
28	11	0	0	1	1	0	cd
29	11	0	1	0	0	1	be
30	11	0	0	1	0	1	ce
31	11	1	0	0	1	1	ade
32	11	1	1	1	1	1	abcde

```
decimals <- 0:31
m <- sapply(decimals,function(x){ as.integer(intToBits(x))})
m[1:5,]

m1<-as.data.frame(t(m[1:5,]))
m1

m2<-m1 %>% mutate(L1=V1+V4+V5, L2=V2+V3+V5, m1=mod(L1,2), m2=mod(L2,2),
                  block=ifelse(m1==0 & m2==0, 1,
                        ifelse(m1==0 & m2==1, 2,
                              ifelse(m1==1 & m2==0, 3,4))))
```

```
m2 <- m2 %>% arrange(block)
m2

library(readr)
group_response <- read_csv("group project/group_response.csv")
y2<- group_response["y2"][complete.cases(group_response["y2"]), ]
y2


df<- cbind(d25, y2)
df
```

```
     Blocks A B C D E effect     y2
1       00 0 0 0 0 0             1.68
2       00 0 1 1 0 0      bc     1.98
3       00 1 1 0 1 0     abd     4.98
4       00 1 0 1 1 0     acd     5.70
5       00 1 1 0 0 1     abe     3.24
6       00 1 0 1 0 1     ace     3.44
7       00 0 0 0 1 1      de     9.97
8       00 0 1 1 1 1    bcde     9.07
9       01 1 1 0 0 0      ab     2.07
10      01 1 0 1 0 0      ac     2.44
11      01 0 0 0 1 0       d     7.77
12      01 0 1 1 1 0     bcd     9.43
13      01 0 0 0 0 1       e     4.09
14      01 0 1 1 0 1     bce     4.53
15      01 1 1 0 1 1    abde    11.75
16      01 1 0 1 1 1    acde    16.30
17      10 0 1 0 0 0       b     2.69
18      10 0 0 1 0 0       c     2.30
19      10 1 0 0 1 0      ad     6.35
20      10 1 1 1 1 0    abcd     6.75
21      10 1 0 0 0 1      ae     4.34
22      10 1 1 1 0 1    abce     4.20
23      10 0 1 0 1 1     bde    10.06
24      10 0 0 1 1 1     cde     9.35
25      11 1 0 0 0 0       a     3.22
26      11 1 1 1 0 0     abc     3.55
27      11 0 1 0 1 0      bd     9.33
28      11 0 0 1 1 0      cd     9.52
29      11 0 1 0 0 1      be     5.91
30      11 0 0 1 0 1      ce     5.83
31      11 1 0 0 1 1     ade    13.23
32      11 1 1 1 1 1   abcde    16.40
```

ABC, ADE are confounded with blocks => it means BCDE = (ABC)(ADE) is also confounded with blocks

---

2.

```
m4<-aov(y2 ~ A*B*C*D*E + Error(Blocks), data=df)
summary(m4)
```

```
meanall<-mean(df$y2)
meanall

summ<-df %>% group_by(Blocks) %>% summarise(meanblk=mean(y), nobs=n()) %>% mutate(ssbl=nobs*(meanblk-meanall)^2)
summ

sum(summ$ssbl)
```

```
Error: Blocks
        Df Sum Sq Mean Sq
A:B:C    1   6.65    6.65
A:D:E    1  48.19   48.19
B:C:D:E  1   0.22    0.22

Error: Within
          Df Sum Sq Mean Sq
A          1   0.62    0.62
B          1   0.01    0.01
C          1   3.19    3.19
D          1 315.32  315.32
E          1  84.34   84.34
A:B        1   0.65    0.65
A:C        1   2.58    2.58
B:C        1   0.09    0.09
A:D        1   2.80    2.80
B:D        1   0.05    0.05
C:D        1   2.03    2.03
A:E        1  17.60   17.60
B:E        1   0.32    0.32
C:E        1   0.27    0.27
D:E        1  13.33   13.33
A:B:D      1   0.06    0.06
A:C:D      1   2.06    2.06
B:C:D      1   0.17    0.17
A:B:E      1   0.01    0.01
A:C:E      1   2.51    2.51
B:C:E      1   0.10    0.10
B:D:E      1   0.16    0.16
C:D:E      1   0.35    0.35
A:B:C:D    1   0.20    0.20
A:B:C:E    1   0.02    0.02
A:B:D:E    1   0.02    0.02
A:C:D:E    1   3.89    3.89
A:B:C:D:E  1   0.39    0.39
```

```
> summ
# A tibble: 4 × 4
  Blocks meanblk  nobs  ssbl
  <fct>    <dbl> <int> <dbl>
1 00       0.593     8 3.08
2 01      -0.151     8 0.124
3 10      -0.224     8 0.312
4 11      -0.326     8 0.713
> sum(summ$ssbl)
[1] 4.227558
> summ<-df %>% group_by(Blocks) %>% summarise(meanblk=mean(y2), nobs=n()) %>% mutate(ssbl=nobs*(meanblk-meanall)^2)
> summ
# A tibble: 4 × 4
  Blocks meanblk  nobs  ssbl
  <fct>    <dbl> <int> <dbl>
1 00        5.01     8 20.5
2 01        7.30     8  3.80
3 10        5.76     8  5.83
4 11        8.37     8 24.9
> sum(summ$ssbl)
[1] 55.05993
```

3. based on anova table and SSBL, factors D, E are significant, while blocks are not significant.

A is confounded with BCDE and ABE.

B is confounded with ACDE and ABE.

C is confounded with ABDE.

D is confounded with ABCE and ADE.

E is confounded with ABCD and ADE.

```
m1<-lm(data=df, y2 ~ D+E)

points<-get_regression_points(m1)
points

shapiro.test(points$residual)

ggplot(data=points, aes(sample=residual)) + stat_qq() + stat_qq_line()
```
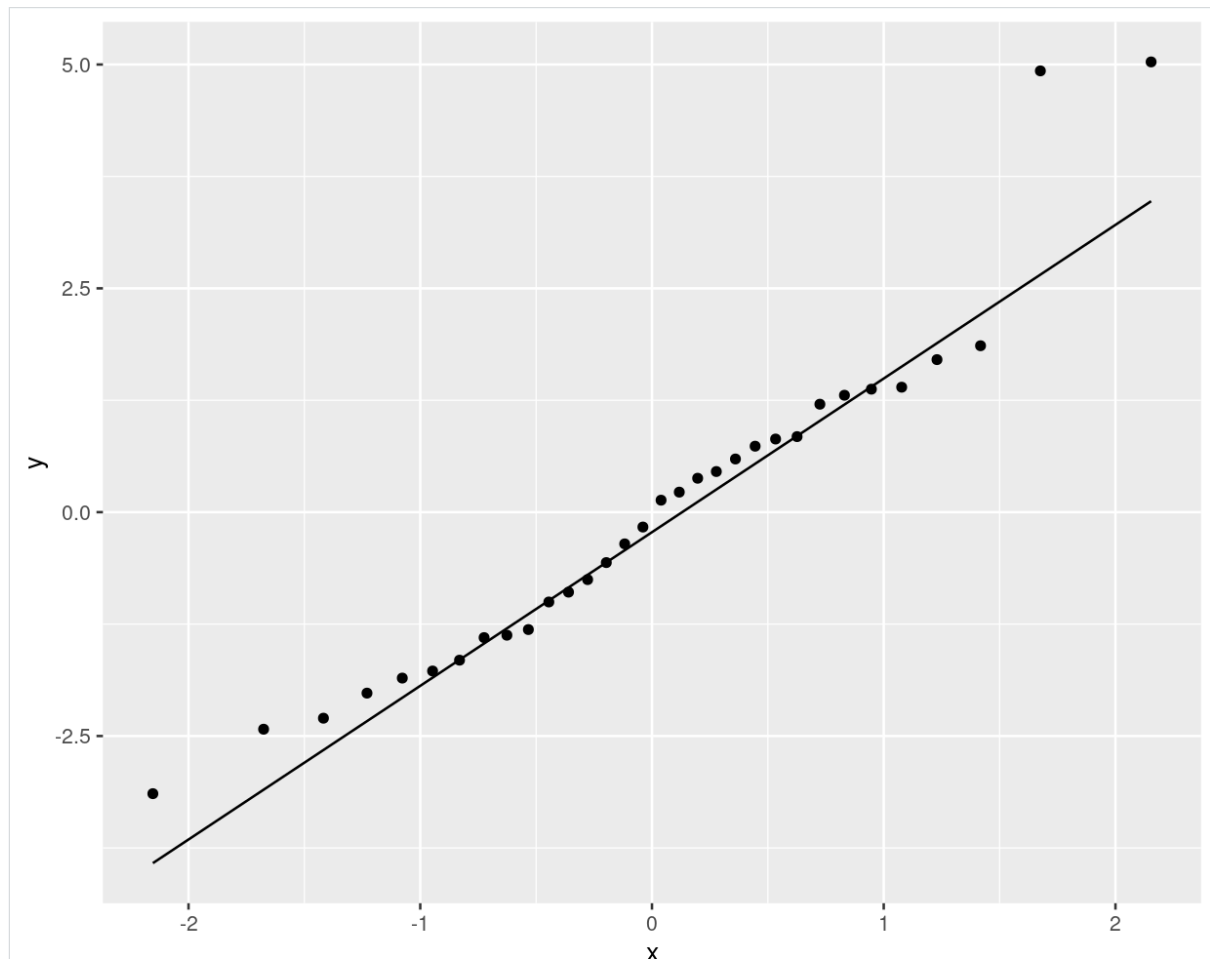
Shapiro-Wilk normality test

data: points$residual
W = 0.93009, p-value = 0.0394

no obvious violation of assumptions.