Lab 8

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Contents

Problem 1A

Consider a 2x2 design. Assume the DV is measured from a normal distribution with mean 0, and standard deviation 1. Assume that the main effect of A causes a total shift of .5 standard deviations of the mean between the levels. Assume that level 1 of B is a control, where you expect to measure the standard effect of A. Assume that level 2 of B is an experimental factor intended to reduce the effect of A by .25 standard deviations.

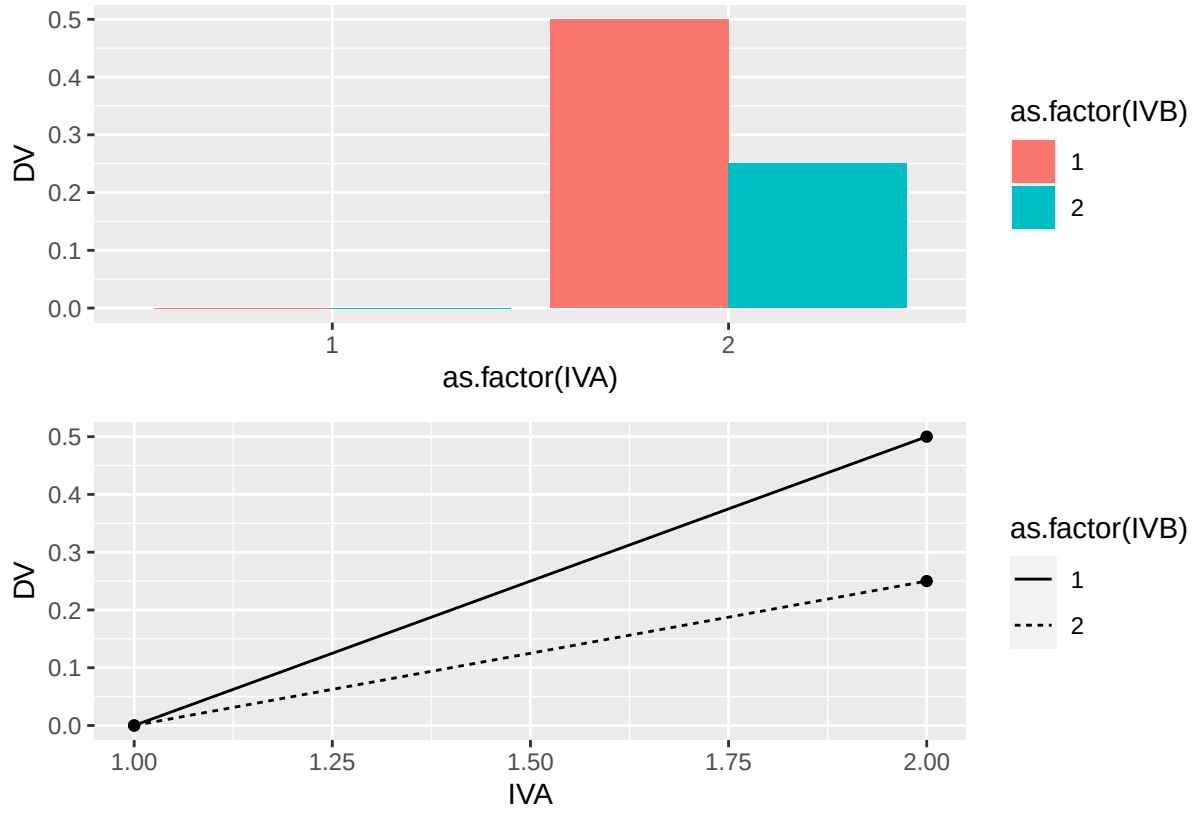
Create a ggplot2 figure that depicts the expected results from this design (2 points)

```
grand_mean <- 0
A <- c(0,.5)
B <- c(0,0)
AB <- c(0,0,0,-.25)

model_data <- tibble()
for(i in 1:length(A)){
  for(j in 1:length(B)){
    IVA <- i
    IVB <- j
    DV <- grand_mean+A[i]+B[j]+AB[(i-1)*length(B)+j]
    sc_GM <- grand_mean
    sc_A <- A[i]
    sc_B <- B[j]
    sc_AB <- AB[(i-1)*length(B)+j]
    row_entry <- tibble(IVA,IVB,DV,
                        sc_GM,sc_A,sc_B,sc_AB)
    model_data <- rbind(model_data,row_entry)
  }
}

knitr::kable(model_data)
```

IVA	IVB	DV	sc_GM	sc_A	sc_B	sc_AB
1	1	0.00	0	0.0	0	0.00
1	2	0.00	0	0.0	0	0.00
2	1	0.50	0	0.5	0	0.00
2	2	0.25	0	0.5	0	-0.25

```
bar_graph <- ggplot(model_data,
                    aes(y=DV,
                        x=as.factor(IVA),
                        fill=as.factor(IVB)))+
  geom_bar(stat='identity', position='dodge')

line_graph <- ggplot(model_data,
                     aes(y=DV,
                         x=IVA,
                         linetype=as.factor(IVB)))+
  geom_line()+
  geom_point()
```

(bar_graph/line_graph)



Problem 1B

Conduct simulation-based power analyses to answer the questions.

How many subjects are needed to detect the main effect of A with power = .8? (2 points)

```
N <- 57

A_pvalue <- c()
B_pvalue <- c()
AB_pvalue <- c()
for(i in 1:1000){
  IVA <- rep(rep(c("1","2"), each=2),N)
  IVB <- rep(rep(c("1","2"), 2),N)
  DV <- c(replicate(N,c(rnorm(1,0,1),
                        rnorm(1,0,1),
                        rnorm(1,.5,1),
                        rnorm(1,.25,1)
        )))
  sim_df <- data.frame(IVA,IVB,DV)

  aov_results <- summary(aov(DV~IVA*IVB, sim_df))
```

```
  A_pvalue[i]<-aov_results[[1]]$`Pr(>F)`[1]
  B_pvalue[i]<-aov_results[[1]]$`Pr(>F)`[2]
  AB_pvalue[i]<-aov_results[[1]]$`Pr(>F)`[3]
}

length(A_pvalue[A_pvalue<0.05])/1000
```

```
## [1] 0.793
```

Problem 1C

How many subjects are needed to detect the interaction effect with power = .8? (2 points)

```
N <- 490

A_pvalue <- c()
B_pvalue <- c()
AB_pvalue <- c()
for(i in 1:1000){
  IVA <- rep(rep(c("1","2"), each=2),N)
  IVB <- rep(rep(c("1","2"), 2),N)
  DV <- c(replicate(N,c(rnorm(1,0,1),
                        rnorm(1,0,1),
                        rnorm(1,.5,1),
                        rnorm(1,.25,1)
          )))
  sim_df <- data.frame(IVA,IVB,DV)

  aov_results <- summary(aov(DV~IVA*IVB, sim_df))
  A_pvalue[i]<-aov_results[[1]]$`Pr(>F)`[1]
  B_pvalue[i]<-aov_results[[1]]$`Pr(>F)`[2]
  AB_pvalue[i]<-aov_results[[1]]$`Pr(>F)`[3]
}

length(AB_pvalue[AB_pvalue<0.05])/1000
```

```
## [1] 0.774
```