Lab4

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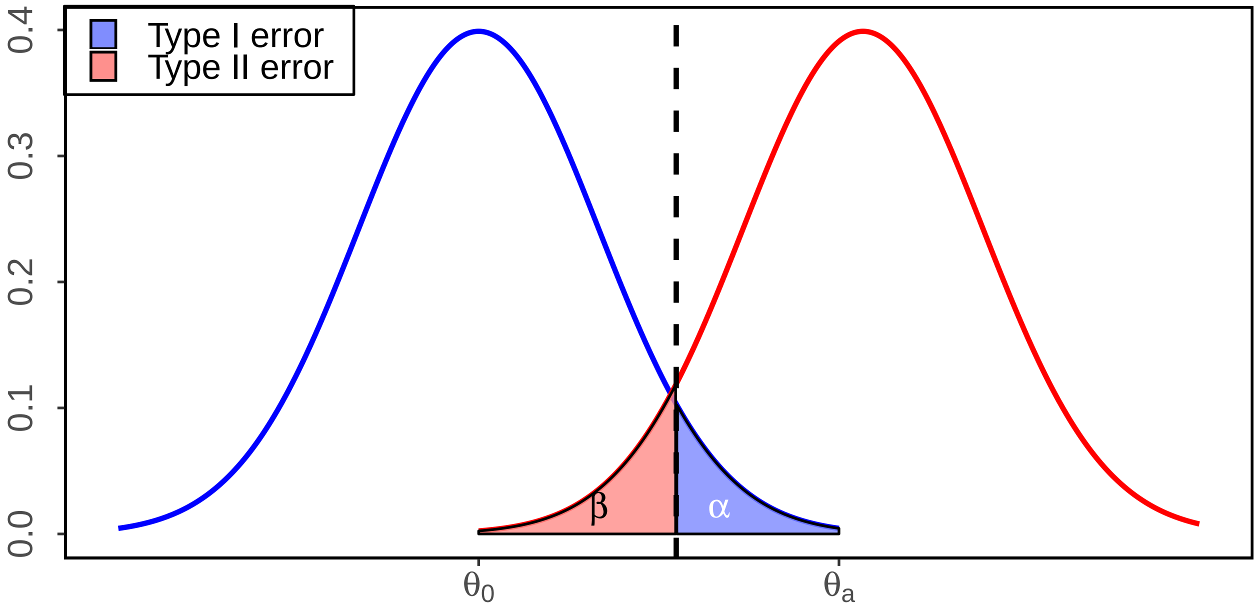
Q1 Write the R code using ggplot function to recreate the graph from the Lecture 8 notes

```
library(ggplot2)
x1=seq(-3,3, by=0.01)
y1=dnorm(x1)
x2 = seq(0,6, by=0.01)
y2 = dnorm(x2, 3.2, 1)
x = c(x1,x2)
y= c(y1,y2)
pdf_df1<-data.frame(x1,y1)
pdf_df2<-data.frame(x2,y2)
p1 <- ggplot()+
  geom_line(aes(x=x1, y= y1),col="blue",lwd = 1)+stat_function(fun = dnorm,args = list(0,1))+
  geom_line(aes(x=x2, y= y2),col="red",lwd = 1)+stat_function(fun = dnorm,args = list(3.2,1))+
  #colored area under curve
  geom_ribbon(data = pdf_df1[pdf_df1$x1 > qnorm(0.95),],
              aes(x = x1, ymin = 0, ymax = y1, fill = "Type I error"), alpha=0.8, colour="black")+
  geom_ribbon(data = pdf_df2[pdf_df2$x2 < qnorm(0.95),],
              aes(x = x2, ymin = 0, max = y2, fill = "Type II error"),  alpha=0.8, colour="black")+
  #change the filling color
  scale_fill_manual(values=c("#7C89FF","#FF8C89"))+
  #add the verticle line
  geom_vline(xintercept = qnorm(0.95), linetype = 2, lwd = 1)+
  #annotate alpha and beta
  annotate("text", x= c(1,2), y= 0.02,
           label = c(paste0(expression(beta)),paste0(expression(alpha))),
           color = c("black","white"),size =5, parse = TRUE)+
  #set up for background of coordinate axis
  theme(panel.background =element_blank(),
        panel.border = element_rect(color = 'black',fill=NA,size = 1),
        axis.text.y = element_text(size = 14, hjust = 0.5, vjust = 3,angle = 90),
        axis.text.x = element_text(size = 14, angle = 0),
        axis.title = element_blank(),
        legend.title = element_blank(),
        text = element_text(size = 18))+
  theme(legend.background = element_rect(fill="NA",color = "black",size=0.5),
        legend.text = element_text(colour="black",size = 14,
                                   margin = margin(t = 0, l = 12, r = 3, b = 0)),
        legend.margin=margin(c(5,5,5,10)),
        legend.position = c(0,1),
        legend.justification = c(0,1),
        legend.key.width = unit(4,"mm"),
        legend.key.height  = unit(2,"mm"))+
  scale_x_continuous(breaks = c(0,3),
    label=c(expression(theta[0]),expression(theta[a])))
```

```
p1
```



Q2 Implement a function that will check if a given positive integer is a prime number.

```
is.prime<-function(x){
  if( x %% 1 ==0){
    if(x<2){
      print(paste(x,"is not a prime number"))
    }
    else{
      n = 1
      for(i in 2:(x-1)){
        if ((x %% i) == 0 ){
          n = 0
          break
        }
      }
      if ( x == 2){
        n =1
      }
      if(n == 1){
        print(paste(x, "is a prime number"))
      }
      else{
        print(paste(x, "is not a prime number"))

      }
    }
  }
  else{
    print(paste(x,"is not valid"))
```

```r
  }
}
#check
is.prime(1)
```

```
## [1] "1 is not a prime number"
```

```r
is.prime(2)
```

```
## [1] "2 is a prime number"
```

```r
is.prime(1.5)
```

```
## [1] "1.5 is not valid"
```

```r
is.prime(9)
```

```
## [1] "9 is not a prime number"
```