Homework 6

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1a)

```
x = rnorm(1000, mean = 0, sd = 1)
for (i in 1:100)
  x[i] = x[i] + 1
pvalue = 2* pnorm(-abs(x))
```

1b)

```
discovery = pvalue < 0.05

type2Error = sum(pvalue[1:100] > 0.05)
type1Error = sum(pvalue[101:1000] < 0.05)
paste0("Number of Type I errors: ", type1Error)
```

```
## [1] "Number of Type I errors: 49"
```

```
paste0("Number of Type 2 errors: ", type2Error)
```

```
## [1] "Number of Type 2 errors: 82"
```

```
paste0("False Discovery Proportion: ", type1Error/sum(discovery))
```

```
## [1] "False Discovery Proportion: 0.73134328358209"
```

1c)

```
BH<-function(p,alpha = 0.05){
    pw<-na.omit(p)
    n<-length(pw)
    pw<-sort(pw)
    comp<-(pw<(1:n)*alpha/n)
    outcome<-sum(comp==TRUE)
    if(outcome>0){
      last<-max((1:n)[comp==TRUE])
      pcut<-pw[last]
      shr<-p*0
      shr[p<=pcut]<-1
      out<-list(shr,sum(shr>0,na.rm=T),pcut)
      names(out)<-c("Reject","Total.Rej","Pcut")
    }
    else
      {
        shr<-p*0
        out<-list(shr,outcome,0)
        names(out)<-c("Reject","Total.Rej","Pcut")
```

```
    }
  return(out)

}
```

1d)

```
bh = BH(pvalue)

# false positive -> reject null when null hypothesis is true (H1 when should be H0)
# false negative -> accept null when null hypothesis is false (H0 when should be H1)

bh_type1 = sum(bh$Reject[101:1000] == 1)
bh_type2 = sum(bh$Reject[1:100] == 0)

paste0("Number of Type I errors: ", bh_type1)
```

```
## [1] "Number of Type I errors: 0"
```

```
paste0("Number of Type 2 errors: ", bh_type2)
```

```
## [1] "Number of Type 2 errors: 100"
```

```
paste0("False Discovery Proportion: ", bh_type1/sum(bh$Reject == 1))
```

```
## [1] "False Discovery Proportion: NaN"
```

1e) The BH method had more type 2 errors than the standard method but less type 1 errors. The FDP for the BH method is also NaN as it had no rejections, but the standard method had an FDP of 73.8%. This indicates that in this case, the standard method is preferable because it has less type 2 errors than the BH method and was able to produce an FDP.