hw3alex

Q1.1

```
data = read.delim("multiple.txt", sep = " ",header=FALSE)
```

```
sample_mean = colMeans(data)
sample_sd = sapply(data, sd)
hnull = hnull = integer(50)

n = nrow(data)
t_statistic = (sample_mean - hnull)/(sample_sd/sqrt(n))

pval = 2*apply(rbind(pt(t_statistic, df = n-1, lower.tail = F),
                     pt(t_statistic, df = n-1, lower.tail = T)), 2, min)
rejection_p <- pval < 0.1
print(pval)
```

```
##           V1           V2           V3           V4           V5           V6
## 7.477468e-34 1.030644e-32 1.613953e-33 5.107798e-37 4.299681e-35 4.181053e-33
##           V7           V8           V9          V10          V11          V12
## 1.782424e-39 2.281744e-34 4.767758e-34 9.020768e-42 8.501800e-01 3.387655e-01
##          V13          V14          V15          V16          V17          V18
## 8.433591e-01 2.353081e-01 8.346443e-01 3.410084e-01 4.495285e-01 8.988573e-01
##          V19          V20          V21          V22          V23          V24
## 4.855360e-01 8.298508e-02 7.435778e-01 4.344605e-01 5.521855e-01 4.775194e-01
##          V25          V26          V27          V28          V29          V30
## 7.573900e-01 1.354197e-01 9.927262e-01 2.944327e-01 6.783256e-01 1.898939e-01
##          V31          V32          V33          V34          V35          V36
## 4.716828e-01 9.302681e-02 4.736660e-01 9.189993e-01 2.138515e-01 6.519921e-01
##          V37          V38          V39          V40          V41          V42
## 3.408716e-01 2.211123e-01 8.806238e-01 7.315268e-02 7.171567e-01 6.472996e-01
##          V43          V44          V45          V46          V47          V48
## 6.915055e-01 2.475067e-02 2.191321e-01 7.678119e-01 3.489369e-01 1.367531e-01
##          V49          V50
## 8.886784e-01 7.316609e-01
```

```
print(rejection_p)
```

```
##    V1    V2    V3    V4    V5    V6    V7    V8    V9   V10   V11   V12   V13
##  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE
##   V14   V15   V16   V17   V18   V19   V20   V21   V22   V23   V24   V25   V26
## FALSE FALSE FALSE FALSE FALSE FALSE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE
##   V27   V28   V29   V30   V31   V32   V33   V34   V35   V36   V37   V38   V39
## FALSE FALSE FALSE FALSE FALSE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##   V40   V41   V42   V43   V44   V45   V46   V47   V48   V49   V50
##  TRUE FALSE FALSE FALSE  TRUE FALSE FALSE FALSE FALSE FALSE FALSE
```

Q1.2

```
alpha = 0.1
FWER = 1 - (1 - alpha)^50
R = sum(rejection_p)
V = sum(rejection_p[11:50])
print(FWER)
```

```
## [1] 0.9948462
```

```
print(V/R)
```

```
## [1] 0.2857143
```

FWER: 0.9948462 FDP: 0.2857143

Q1.3

```
pval.bon = p.adjust(pval, method = "bonferroni")
rejection_bon = pval.bon < 0.1
print(rejection_bon)
```

```
##    V1    V2    V3    V4    V5    V6    V7    V8    V9   V10   V11   V12   V13
##  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE FALSE FALSE FALSE
##   V14   V15   V16   V17   V18   V19   V20   V21   V22   V23   V24   V25   V26
## FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##   V27   V28   V29   V30   V31   V32   V33   V34   V35   V36   V37   V38   V39
## FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
##   V40   V41   V42   V43   V44   V45   V46   V47   V48   V49   V50
## FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
```

```
FWER.bon = 1 - (1 - alpha/50)^50
print(FWER.bon)
```

```
## [1] 0.09525318
```

FWER: 0.09525318

Q1.4

```
pval.bh = p.adjust(pval, method = "BH")
rejection_bh = pval.bh < 0.1
alphas = 0.1 * seq(1/50, 1, by = 1/50)
FWER.bh = 1 - prod(1 - alphas)
FDP_bh = sum(rejection_bh[11:50])/sum(rejection_bh)
print(FWER.bh)
```

```
## [1] 0.928672
```

```
print(FDP_bh)
```

```
## [1] 0
```

BH's FWER is slightly lower than step1 and way higher than step2 but BH's FDP is 0, which is way lower than step1 and 3.