Assessed Problem Sheet 1

Statistics 1

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```
load(url("https://people.maths.bris.ac.uk/~maxca/stats1/stats1-assignment.RData"))
```

Question 4

```
compute.ad.test <- function (xs) {
  len<-length(xs)  # Length of vector
  sorted<-sort(xs) # Sort vector

  xBar<-mean(xs)   # Sample mean
  S<-sd(xs)        # Sample standard deviation

  summation<-0
  for (j in 1:len) {                            # Calculate each element of summation
    scalar<-(2*j-1)/len                         # Scalar of element
    first<-log(pnorm(sorted[j],xBar,S))         # First ln term
    second<-log(1-pnorm(sorted[len+1-j],xBar,S)) # Second ln term
    element<-scalar*(first+second)              # Value of j^th of summation
    summation<-summation+element                # Add to summation
  }

  T<--length(xs)-summation # Test statistic
  return (T)
}
compute.ad.test(x1)
```

```
## [1] 0.4369709
```

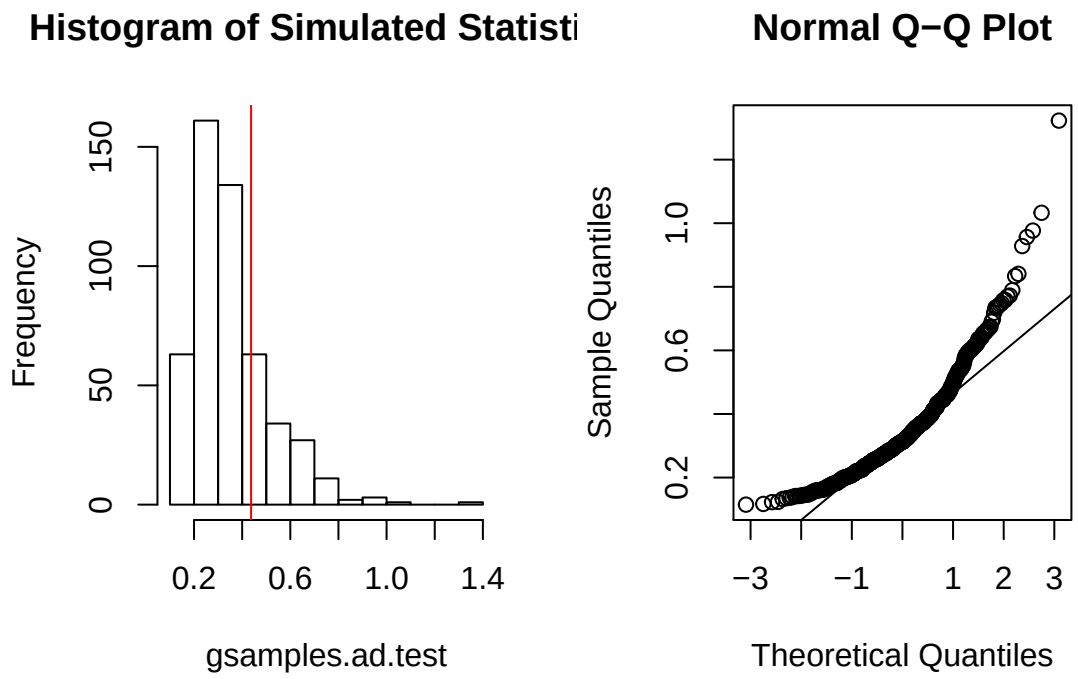
```
compute.ad.test(x2)
```

```
## [1] 0.8406134
```

Question 6

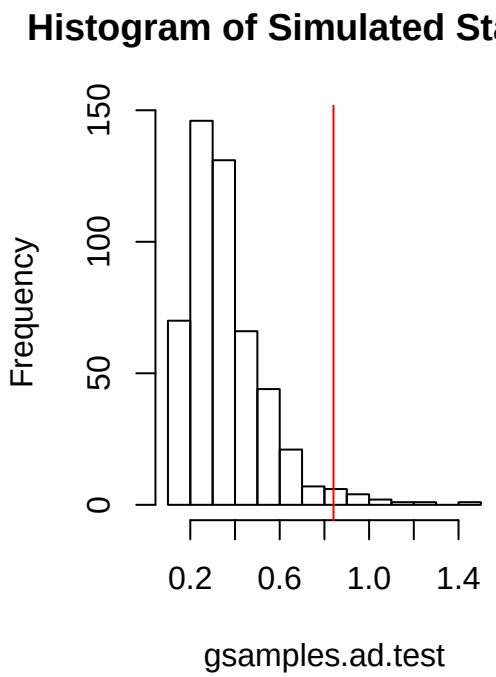
```
compute.ad.pvalue <- function (xs) {
  sampleSize=10  # Size of each sample
  numSamples=500 # Number of samples

  xBar<-mean(xs)             # Sample mean
  s<-sd(xs)                  # Sample standard deviation
  t_obs<-compute.ad.test(xs) # Observed Statistic

  gvalues<-rnorm(sampleSize*numSamples,xBar,s)        # Generate values from N(xBar,s)
  gsamples<-matrix(gvalues,nrow=numSamples)           # Group into samples
  gsamples.ad.test<-apply(gsamples,1,compute.ad.test) # Calcualate AD statistic for each sample
```

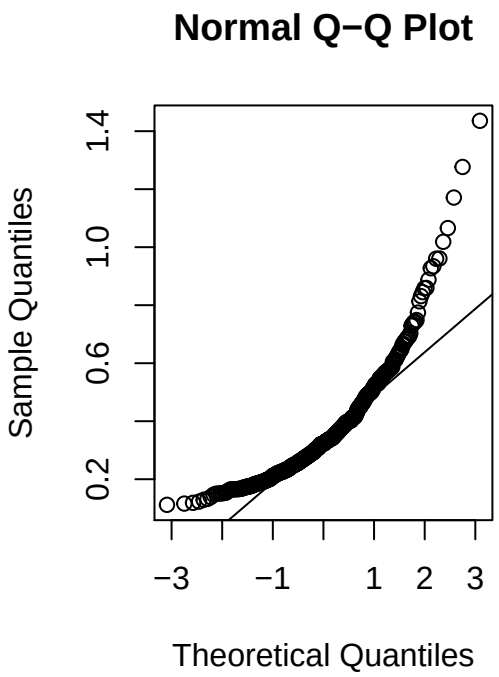
```
  num=sum(gsamples.ad.test>=t_obs) # Number of simulated statistics >= given
  p=num/numSamples                 # As proportion

  # Create plots
  par(mfrow=c(1,2))
  hist(gsamples.ad.test,main="Histogram of Simulated Statistics")
  abline(v=t_obs,col="red")
  qqnorm(gsamples.ad.test)
  qqline(gsamples.ad.test)

  return (p)
}

compute.ad.pvalue(x1)
```




```
## [1] 0.234
```

```
compute.ad.pvalue(x2)
```


Histogram of Simulated Statisti
Frequency
0
50
100
150
0.2
0.6
1.0
1.4
gsamples.ad.test


Normal Q−Q Plot
Sample Quantiles
0.2
0.6
1.0
1.4
−3
−1
1
2
3
Theoretical Quantiles

```
## [1] 0.026
```