Assignment-

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1 Question A

Code for R

```
rm(list = ls())
p = 0.3;
alpha = 0.05;

n = 1000;
M = c(20, 50, 100, 500, 1000);

Ps = seq(0.001, 1-0.001, 0.001);
z = qchisq(1-alpha, 1);

for (m in M) {
   covProb = 0;
   crossL = 0;
   crossU = 0;

   X = rbinom(m*n, size = 1, prob = p);
   p_0 = sum(X)/(n*m);
   # print(p_mle); print(length(X))

   for (i in 1:n) {
      Y = X[((i-1)*m + 1) : (i*m)];

      p_mle = mean(Y);
      LogL_mle = m*p_mle*log(p_mle) + m*(1-p_mle)*log(1-p_mle);
      LogL_Ps = m*p_mle*log(Ps) + m*(1-p_mle)*log(1-Ps);
      temp = 2*(LogL_mle - LogL_Ps) < z;

      cil = min(Ps[temp]);
      ciu = max(Ps[temp]);

```

```
31        if (!is.na(cil) || !is.na(ciu)) if ((cil <= p_0) && (p_0 <= ciu)) {
32            covProb = covProb + 1;
33        }
34    }
35
36    LogL_0 = m*p_0*log(p_0) + m*(1-p_0)*log(1-p_0);
37    LogL_Ps = m*p_0*log(Ps) + m*(1-p_0)*log(1-Ps);
38    temp = 2*(LogL_0 - LogL_Ps) < z;
39    cil = min(Ps[temp]);
40    ciu = max(Ps[temp]);
41
42    cat(sprintf("\nBernoulli sample count = %d\\\\\np_0 = %f\\\\\n", m, p_0));
43    cat(sprintf("Using Likelihood Ratio Test Confidence Interval = [%f, %f]\\\\\n", cil, ciu));
44    cat(sprintf("Coverage Probability = %f\\\\\n", covProb/n));
45 }
```

Bernoulli sample count = 20

p0 = 0.300400

Using Likelihood Ratio Test Confidence Interval = [0.133000, 0.516000]

Coverage Probability = 0.956000

Bernoulli sample count = 50

p0 = 0.297460

Using Likelihood Ratio Test Confidence Interval = [0.184000, 0.432000]

Coverage Probability = 0.955000

Bernoulli sample count = 100

p0 = 0.299070

Using Likelihood Ratio Test Confidence Interval = [0.216000, 0.393000]

Coverage Probability = 0.958000

Bernoulli sample count = 500

p0 = 0.298872

Using Likelihood Ratio Test Confidence Interval = [0.260000, 0.339000]

Coverage Probability = 0.950000

Bernoulli sample count = 1000

p0 = 0.299089

Using Likelihood Ratio Test Confidence Interval = [0.272000, 0.327000]

Coverage Probability = 0.948000

2 Question B

Code for R

```
rm(list = ls())
d = read.table("d-csp0108.txt", header=TRUE)
names = c('C', 'SP')
T = length(d[,1]);

# Calculating log returns
for (k in 2:3) {
   d[,k] = log(1 + d[,k]);
}

skew <- function(X) {
   T = length(X);
   mu = mean(X);
   sig = sqrt( sum((X-mu)^2)/(T-1) );
   sk = sum((X-mu)^3)/(T-1) / sig^3;
   return (sk);
}

kurt <- function(X) {
   T = length(X);
   mu = mean(X);
   sig = sqrt( sum((X-mu)^2)/(T-1) );
   kt = sum((X-mu)^4)/(T-1) / sig^4;
   return (kt);
}

alpha = 0.05;
type = c('Skewness', 'Excess Kurtosis');

for (k in 2:3) {
   for (ty in type) {
      X = d[,k];

      if (ty == 'Skewness') {
         theta = skew(X);
         sig = sd(X)*sqrt(6/T);
         clb = sig*qnorm(alpha/2); cub = sig*qnorm(1 - alpha/2);
      } else {
         theta = kurt(X) - 3;
         sig = sd(X)*sqrt(24/T);
         clb = sig*qnorm(alpha/2); cub = sig*qnorm(1 - alpha/2);
      }


      cat(sprintf('\n%s Stock\\\\\n', names[k-1]));
      cat(sprintf('The %d%% confidence interval for %s = [%f, %f]\\\\\n', 100*(1-alpha), ty,
          clb, cub));
```

```
47      if ((clb <= theta) && (theta <= cub)) {
48         cat(sprintf('The %s = %f is inside the confidence interval.\\\\\n\n', ty, theta));
49      } else {
50         cat(sprintf('The %s = %f is not inside the confidence interval.\\\\\n\n', ty, theta))
               ;
51      }
52   }
53 }
```

C Stock

The 95% confidence interval for Skewness = [-0.107058, 0.107058]

The Skewness = 0.538650 is not inside the confidence interval. Hypothesis False

C Stock

The 95% confidence interval for Excess Kurtosis = [-0.214115, 0.214115]

The Excess Kurtosis = 42.760151 is not inside the confidence interval. Hypothesis False

SP Stock

The 95% confidence interval for Skewness = [-0.107058, 0.107058]

The Skewness = -0.140850 is not inside the confidence interval. Hypothesis False

SP Stock

The 95% confidence interval for Excess Kurtosis = [-0.214115, 0.214115]

The Excess Kurtosis = 9.956392 is not inside the confidence interval. Hypothesis False