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University Examinations 2022/2023

SECOND YEAR, FIRST SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE

SECOND YEAR, FIRST SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE
DEGREE OF BACHELOR OF SCIENCE IN STATISTICAL SCIENCE

SMS 3213: COMPUTER INTERACTIVE STATISTICS

DATE: AUGUST 2023

TIME: 2 HOURS

INSTRUCTIONS: *Answer question one and any other two questions*

QUESTION ONE (30 MARKS)

- a) Given the following elements, 5.8, -3.9, -21, 8.5, 4.2. write appropriate R code that
- Arranges the above elements from lowest to the highest and give the expected output (2 marks)
 - Arranges the above elements from highest to the lowest and give the expected output (2 marks)
- b) Write what the R code does and the R out of the following
- `Ourmatrix<-matrix(2,4,3,1-1,6),nrow=2,ncol=3,byrow=TRUE)` (2 marks)
 - `Ourmatrix<-matrix(2,4,3,1-1,6),nrow=2,ncol=3,byrow=FALSE)` (2 marks)
 - `seq(1,10)` (2 marks)
 - `s1,-seq(1,10,by=0.5)` (2 marks)
 - `s2<-rep(c(1,4),c(10,15))` (2 marks)
- c) The Poisson distribution is often used to model count data
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- i) Write an R code that generates 10 numbers from the Poisson distribution with a mean of 2 (2 marks)
 - ii) Write an R code that computes $P(X = 3)$ (1 mark)
 - iii) Write an R code that computes $P(X \geq 1)$ (2 marks)
- d) Jane has kept a record on the number of times she commutes for the last 9 days which shows the following times in minutes 20,17,16,22,24,21,15,17,22
- i) Write an R code for entering the data in R to a vector named “commuting” (1 mark)
 - ii) Write an R code for getting mean, the longest commuting time, the lowest commuting time and give the expected results (3 marks)
 - iii) She realizes that 24 was a mistake and should have been 18. Write an R code that will fix this (1 mark)
 - iv) Write an R code which shows the number of times Jane commuted 19 minutes or more (1 mark)
- e) A manufacturer of a certain type of bread knows that the total weight of the breads in its 80 gram advertised package X is normally distributed with a mean of 80.2 g and standard deviation of 1.1 grams. The manufacturer weights the contents of randomly selected individual packets
- i) Write an R code that determines the probability of randomly selected packet is less than 78 grams (1 mark)
 - ii) R code that the probability of a packet is found to weigh between 80.5 and 81.5g (2 marks)
 - iii) The weight below which the lightest 20 percent of packet lie (2 marks)

QUESTION TWO (20 MARKS)

- a) The following R program was run

```
Matrix1<-matrix(c(2,4,3,1),nrow=2,ncol=3,byrow=FALSE)
```

```
Matrix1
```

The program could not run

- i) Identify the mistake and explain why it couldn't run (2 marks)
- ii) Write the correct R code and hence the correct output (2 marks)



- b) For a normal random variable X with mean 5 and standard deviation 2, write an R code that will
- i) Compute the probability that X is less than 3 (1 mark)
 - ii) Computes the probability X is greater than 4.5 (1 mark)
- c) Write an R code that generates sequence of real numbers from 1 to 7 with an interval of 0.5 and give the expected output. In your written R code, what does the first number, second number and third number indicate (5 marks)
- d) The following are two sets of data

X	2	4	0.4	3	0.2
Y	1	7	0.2	2	4

Write appropriate R codes that does the following

- i) Enters X data into an object called “Xdata” (1 mark)
- ii) Enters Y data into an object named “Ydata” (1 mark)
- iii) Computes the mean Xdata (1 mark)
- iv) Computes the mean of Ydata (1 mark)
- v) Generates descriptive statistics of Xdata (1 mark)
- vi) Generates descriptive data of Ydata (1 mark)
- vii) Generates standard deviation of Xdata (1 mark)
- viii) Generates standard deviation of Ydata (1 mark)
- ix) Generates a summary of Xdata (1 mark)

QUESTION THREE (20 MARKS)

- a) Determine the output displayed in the following R program by systematically displaying The matrix at each stage (4 marks)

```
Matrix1<-matrix(c(5,6,2,-3), nrow=2, ncol=2, byrow=TRUE)
```

```
Matrix
```

```
Matrix2<-matrix(c(2,6,2,3-1,6), nrow=3,ncol=2,byrow=FALSE)
```

```
Matrix2
```

```
Summatrix<-Matrix1+Matrix2
```



- b) Explain what each line of the R code does and give the expected outputs for each
- i) `K<-cbind(L=1:3,M=4:6, N=4)` (3 marks)
 - ii) `K1<-rbind(L=1:3, M=4:6, N=4)` (3 marks)
 - iii) `B<-rbind(c=1,3,4),5:3,c(100,20,90),11:13)` (3 marks)
 - iv) Write an R code that provides the order (number of rows and columns) of the matrix obtained in (iii) above (3 marks)
- c) When tossing a fair coin 10 times, write R code to find the probability
- i) Seeing no head (1 mark)
 - ii) Seeing exactly 5 heads (1 mark)
 - iii) Seeing more than 7 heads (1 mark)
 - iv) Seeing exactly 1 head (1 mark)

QUESTION FOUR (20 MARKS)

- a) Write an R code that does the following
- i) Creates 10 random numbers from normal (0,10) and stores it in “J” (1 mark)
 - ii) Finds the maximum values of J (1 mark)
 - iii) Finds the minimum values of J (1 mark)
 - iv) Repeats $x = 1$ four times and give the output (2 marks)
 - v) Repeats Y with these elements (3,62,8.3) three times and give the expected output (2 marks)
 - vi) Repeats Y in (iv) above each of the element 2 times and give the output (2 marks)
 - vii) Repeats Y in (iv) above three times and each element twice and give the output (2 marks)
 - viii) Arranges the above elements 2.5, -1, -10, 3.44 from the lowest to the highest and give the expected output (2 marks)
 - ix) Arranges the above elements in (vii) from the highest to the lowest and give the output (2 marks)
- b) Write an R code that
- (i) Generates five random numbers from $X \sim N(22,1.5)$ distribution (1 mark)
 - (ii) Calculates standard deviation of X and saves it in object X2 (1 mark)



- (iii) Calculate standard deviation of X and saves it in object X2 (1 marks)
- c) Write an R code that creates and fills a 2x2 matrix in a column wise fashion with the following elements and stores it in B and give the expected output (2 marks)

QUESTION FIVE (20 MARKS)

- a) A customer claims that after sampling 15 breads supplied by the manufacturer the mean of the bread could not have been 80 grams. The grams of the sampled bread were as follows

87.7	80.01	77.28	78.76	81.52	74.20	80.71	79.5
77.89	81.94	80.7	82.32	75.78	80.19	83.91	

The manufacturer wants to conduct a hypothesis using a significance level of $\alpha = 0.05$ using the sampled data

- i) Write an R code that enters this data and store it in object named “bread” (1 mark)
- ii) R code that calculates the average weight of bread and saves it in an object named “bread.m” and also give the expected output (2 marks)
- iii) R code that calculates the standard deviation of the sample mean and save it as “bread.s” and also give the expected output (2 marks)
- iv) R code that calculates the standard error of the sample mean and save it as “bread.se” (2 marks)
- b) On average two cars arrive at a particular car wash every hour on any day of the week. Let the discrete random variable y represent the number of cars that arrive between 10 am and 12 noon on Thursday.
- i) State the distribution of Y and give the formula for the probability mass function of Y (2 marks)
- ii) Write an R code that computes the probability that the car wash remains idle during this period (1 mark)
- iii) Write an R code that computes the probability that between 2 and 5 cars (inclusive) arrive during this period (1 mark)



- c) Write a code that does the following
- i) Creates a vector A which comprises the numbers 1, 2 and 3 each repeated 17 times without using the concatenate function. This will be the sample data you will use for the next 4 questions (1 mark)
 - ii) Find the sample size and stores it in an object named “n” (1 mark)
 - iii) Computes the mean and standard deviation of the sample (1 mark)
 - iv) Computes the standard error of the point estimate of the sample (1 mark)
- d) Given the following elements 0.3, 4.5, 55.3, 91.0, 0.1, 105.5, -4.2, 8.2, 27.9
Write a R code to create a 3x3 matrix and save it in object named A and give the expected output (4 marks)

