MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS

2023/2024

SCHOOL OF PURE APPLIED AND HEALTH SCIENCES

BACHELOR'S OF SCIENCE APPLIED STATISTICS WITH COMPING AND

BACHELOR'S OF SCIENCE MATHEMATICS

FIRST YEAR SECOND SEMESTER

COURSE CODE: STA 1209-1

COURSE TITLE: Computing Methods I

DATE: **TIME:**

INSTRUCTIONS:
Attempt Question one and any other Two Questions

Question One

a. Determine the results of the following computations in R.
   i. 1000/(45 + 34). **(1 mark)**
   ii. (12 + 60) >= (73). **(1 mark)**
   iii. 81%%9. **(1 mark)**
   iv. (125%%8) <3. **(1 mark)**
   v. (71%%6) = = (65%%11). **(1 mark)**

b. Write an R function that will be used to compute the volume of a cone with a default radius of 7 cm and perpendicular height of 10 cm. **(3 marks)**

c. Write R code that will be used in estimating the following integrals using Monte Carlo technique.

   i. $\int_0^{200} 2x^2 e^{2x+5}.dx$ **(3 marks)**

   ii. $\int_2^5 \cos 4x\left(4x^2+3x-2\right).dx$ **(3 marks)**

   iii. $\int_{10}^{20} 2x \ln 4x^2.dx$ **(3 marks)**

d. Write an R code that will be used in simulating random 1000 observations from an exponential distribution with parameter $\lambda = 20$. **(3 marks)**

Question Two

a. Below is a system of linear equation. Write down a sequence of R code that would be used to solve the linear system of equations using matrix algebra. **(6 marks)**

$$2x+3y-4z+6w=180$$
$$x+14y+2z-3w=236$$
$$9x-2y-3z+12w=350$$
$$7x+y+3z-8w=45$$

b. Write an R code that will be used to simulate 1000 observations of random variable X from geometric distribution with parameter $p = 0.48$. **(6 marks)**

c. Write an R code that would be used to generate squares of even numbers between 100 and 200 inclusive starting with the square of 200. **(3 marks)**

Question Three

a. Discuss the three control structures used in programming. **(6 marks)**
b. Write an R code that will be used in simulating data to confirm the Central Limit Theorem using the Monte Carlo approach. **(5 marks)**

c. Write code for an R function in computing the volume of a cylinder with radius of 10 cm and height of 100 cm. **(4 marks)**

Question Four

a. Consider a simple linear regression model

$Y = 2 - 3X + \varepsilon$

where

$\varepsilon \sim N(0,1)$ and $X \sim Pois(4)$

i. Write an R code that will be used in simulating 100 observations of X and Y in the above regression model and store it in a data frame called **"Regression Simulation"**. **(5 marks)**

ii. Using the estimated data in (i), write an R code that will estimate the above regression model and present the results. **(4 marks)**

b. Write R code that will compute the following integrals using Monte Carlo Simulation technique.

i. $\int_{100}^{200} \ln(4x^3)dx$ **(3 marks)**

ii. $\int_{40}^{180} 10x^3 - 2x^2 + 9x - 100.dx$ **(3 marks)**