PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

FIRST SEMESTER EXAMINATIONS – 2021

SECOND YEAR BACHELOR SCIENCE IN COMPUTER SCIENCE

CS 213 – CONCEPTS OF COMPUTER SCIENCE

TIME ALLOWED: 3 HOURS

INFORMATION FOR CANDIDATES

1. You have 10 minutes to read this paper. You must not begin writing during this time.
2. Write your name and student number clearly on the front of the examination answer booklet.
3. There are 6 questions. You should attempt **ALL questions**.
4. All answers must be written in the examination answer booklet(s) provided. No other written material will be accepted.
5. Start the answer for each question on a **new** page. Do **not** use red ink or pencil.
6. Notes and textbooks are not allowed in the examination room.
7. Mobile phones and other recording devices are not allowed in the examination room.

MARKING SCHEME

Marks are as indicated at the beginning of each question. Total mark is **100**.

Question 1 [(5 + 5) + 5 = 15 Marks]

If the union of the set, $\boldsymbol{A} = \{1,2,3,4,5,6,7\}$ the set $\boldsymbol{B} = \{2,4,6,8\}$ and the set $\boldsymbol{C} = \{3,6,9\}$ form the universal set $\boldsymbol{U}$.

a) Then, using the sets ***A*** and ***B*** find the following:

   i) $B \backslash (A \backslash C)$

   ii) $A \cup \bar{B}$

b) Prove the following De Morgan's Law using sets ***A*** and ***B***

$$\overline{A \cap B} = \bar{A} \cup \bar{B}$$

Question 2 [10 + 10 + 5 = 25 Marks]

a) Solve the following system of equations using Gauss – Jordan Elimination

$$\begin{aligned} x + y + 2z &= 9 \\ 2x + 4y - 3z &= 1 \\ 3x + 6y - 5z &= 0 \end{aligned}$$

b) Find the inverse of the given matrix ***A*** using the **method of cofactors.**

$$\begin{bmatrix} 3 & 2 & -1 \\ 1 & 6 & 3 \\ 2 & -4 & 0 \end{bmatrix}$$

c) Let $\boldsymbol{A} = \begin{bmatrix} 2 & 3 \\ -1 & 1 \end{bmatrix}$ and $\boldsymbol{B} = \begin{bmatrix} 1 & 9 \\ -3 & k \end{bmatrix}$. What value(s) of ***k*** if any will make $\boldsymbol{AB} = \boldsymbol{BA}$?

Question 3 [5 + 5 + 5 = 15 Marks]

Given the vectors $\boldsymbol{u} = (2, 3, -1)$ and $\boldsymbol{a} = (0,2,-3)$

a) Find the dot product $\boldsymbol{u} \cdot \boldsymbol{a}$ and the angle θ between $\boldsymbol{u}$ and $\boldsymbol{a}$.

b) Find the orthogonal projection of $\boldsymbol{u}$ on $\boldsymbol{a}$.

c) Find the vector component of $\boldsymbol{u}$ orthogonal to $\boldsymbol{a}$.

Question 4 [10 + (5 + 3) + 2 = 20 Marks]

The following table summarizes the number of times a group of students were absent from a class and the marks that each student scored (out of 100) in the subsequent exam that followed.

No. of times absent (x)	7	11	9	13	15	17	16	12
Marks scored (y)	86	80	83	77	74	71	73	79

From the information presented above,

a) Analyze the results in a table and calculate the **correlation coefficient *r*.**

Hint: $$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

b) Calculate the regression coefficient $(\boldsymbol{b})$ and the y-intercept $(\boldsymbol{a})$ of the regression line.

Hint: $$\boldsymbol{b} = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}, \qquad \boldsymbol{a} = \bar{y} - b\bar{x}$$

Question 5 [5 + 5 + 5 = 15 Marks]

From a group of 6 mathematicians and 9 engineers, a committee consisting of 5 members have to be formed. In how many ways can this be done if;

a) The committee must contain 2 mathematicians and 3 engineers
b) The committee must contain only engineers
c) The committee must contain only mathematicians

Question 6 [5 + 5 = 10 Marks]

Suppose you are to select 3 students from among 4 males and 3 females

a) What is the probability of selecting 2 males?
b) What is the probability of selecting **at least** 2 females?

END OF EXAMINATION