



UNIVERSITY EXAMINATIONS
EXAMINATION FOR THE AWARD OF DIPLOMA IN
COMPUTER SCIENCE

COSC 0170: MATHEMATICS FOR COMPUTING 1

TIME: 2 HOURS

CAMPUSES: THARAKA

INSTRUCTIONS:

- Answer question **ONE** and **TWO** other questions
- Do not write anything on the question paper
- This is a **closed book exam**, no reference materials are allowed in the examination room
- There will be **NO** use of mobile phones or any other unauthorized materials
- Write your answers legibly and use your time wisely.

Question one (30 marks)

- a. Let $A = \{3, 4, 6, 7, 8\}$, $B = \{2, 4, 5, 6, 8\}$ and $C = \{1, 2, 4, 5, 8\}$. What are the elements of the set $(A \setminus B) \cup (C \cap B)$? [4 marks]
- b. List all elements of the following sets:
 - i. $\{3k + 1 \mid k \in \{2, 3, 4\}\}$ [3 marks]
 - ii. $\{k^2 \mid k \in \{-1, 0, 1, 2\}\}$ [2 marks]
 - iii. $\{u - v \mid u \in \{3, 4, 5\}, v \in \{1, 2\}\}$ [3 marks]
- c. Draw a Venn diagram for the following sets:
 - i. $(A \setminus B) \cap C$, [2 marks]
 - ii. $(A \setminus B) \cap (B \setminus C) \cap (A \setminus C)$, [3 marks]
- d. Write the following expressions in summation notation.
 - i. $1 + 4 + 7 + 10$, [2 marks]
 - ii. $2 + 4 + 6 + 8 + 10$, [3 marks]
- e. Compute the values of $n!$ for every $n \in \{0; 1; 2; 3; 4; 5; 6; 7; 8\}$ [4 marks]
- f. What is the sum of the binary numbers $(1011)_2 + (1111)_2 + (11)_2$ [4 marks]

SECTION 2

Question two (20 marks)

- In Hungary there is a game called “TOTÓ”, where one bets on the outcome of certain football games. There are 13+1 games one can bet on, and there are 3 choices for each of them: one writes '1' if they think that the first team wins, one writes '2' if they think that the second team wins, and 'X' means that the result is a draw. How many TOTÓ tickets should be filled out to make sure that one of them will be correct for all 13+1 games? [5 marks]
- In a company the following system is used to record the people working there: in the first record the name of the person is written as a 20 long string with possible spaces. Then the gender of the person is put into the next record (male/female). Then follows the person's job title in a 10 letter long string, and finally comes the payment of the person as an at most 8 digit non-negative integer in base 10. How many people records can be stored in this system if we allow empty names/job titles, as well? [6 marks]
- The Hungarian alphabet contains 44 letters. How many 5, 7, 10 letter long (not necessarily meaningful) words can be created using Hungarian letters? [4 marks]
- Five boys and three girls buy cinema tickets. They receive the tickets in the same row, their seats are numbered from 1 to 8. How many different ways can they sit on the seats? How many different ways can they sit on the seats if boys sit on seats from 1 to 5, and girls sit on seats from 6 to 8? [5 marks]

Question three (20 marks)

- find the domain and range of the $f(x) = 1/x^2$ [5 marks]
- Given the equation $x^2 + 2y - 3 = 0$. [4 marks]
- Given $f(x) = x+3$ find the $\lim_{x \rightarrow 4} f(x)$. [3 marks]
- Find the limit
 - $\lim_{x \rightarrow 2} x^2$ [3 marks]
 - $\lim_{x \rightarrow 2} x^3$ [3 marks]
- Show the formula of a linear function. [2 marks]

Question Four (20 marks)

- Define the terms
 - Multiset [2 marks]
 - Power set [2 marks]
- List FOUR properties of set. [4 marks]
- Define the term partition. [2 marks]
- Compute the partition of a set $X = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ [4 marks]
- Let M, P and C be the sets of students taking Mathematics courses, Physics courses and Computer Science courses respectively in a university. Assume $|M| = 300$, $|P| = 350$, $|C| =$

450, $|M \cap P| = 100$, $|M \cap C| = 150$, $|P \cap C| = 75$, $|M \cap P \cap C| = 10$. How many students are taking exactly one of those courses? Use Venn diagram. [6 marks]

Question Five (20 marks)

- a. Discuss the rules of differentiation. [10 marks]
- b. Suppose that $r(x) = 9x$ and $c(x) = x^3 - 6x^2 + 15x$, where x represents thousands of units. Is there a production level that maximizes profit? If so, what is it? [5 marks]
- c. Discuss the properties of limit. [5 marks]