

Course No: **ESGD2206**
Course Title: **Introduction to Discrete Mathematics**
Date: **13/01/2011**
No. of Questions: **5**
Time: **2 hr**
Using Calculator (**Yes**)

University of Palestine

Final Exam
First term 2010/2011
Total Grade: **60**

Instructor: **Eng. Tasneem Darwish**
Student No.: _____
Student Name: _____
College Name: **Eng. College**
Dep. / Specialist: **Software Engineering**
Using Dictionary (**No**)

First Question

(10)

Q1 (a): Prove that p logically implies (q → p).

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Q1(b): using mathematical induction, prove that for all positive integers n

$$1 + 2 + \dots + n = \frac{1}{2}n(n + 1).$$

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Second Question

(14)

Q2 (a): List the elements of the following set, using the ‘...’ notation where necessary: $\{x : x \text{ is a positive integer multiple of five}\}$

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Q2 (b): Let $U = \{1, 2, 3, \dots, 10\}$, and $A = \{1, 3, 4, 5\}$, $B = \{3, 5, 7, 8\}$, $C = \{1, 3, 5, 7, 9\}$ Draw Venn diagram and shade the region representing the following set: $(A - B) \cup C$

Q2 (c): Given that $|A| = 55, |B| = 40, |C| = 80,$
 $|A \cap B| = 20, |A \cap B \cap C| = 17, |B \cap C| = 24,$ and $|A \cap C| = 10$

Find: $|A \cup B \cup C|$

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Q2 (d): Let $A = \{1, 2, 3, 4\}$ list the elements of the power set of A then write a partition for A

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Q2 (e): Let $X = \{(1, 2)\}$ $Y = \{a, b, c, d, e\}$ list the elements of $X \times Y$

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Third Question

(20)

Q3 (a): For the following relation R on a set A, draw:

- (a) its coordinate grid diagram,**
- (b) its directed graph,**
- (c) its binary matrix, and**
- (d) its arrow diagram.**

$A = \{a, b, c, d, e\};$

$R = \{(a, b), (a, c), (a, e), (b, c), (c, a), (c, d), (d, e), (e, c), (e, d)\}.$

<u>coordinate grid diagram</u>	<u>directed graph</u>
<u>binary matrix</u>	<u>arrow diagram</u>

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Q3 (b): Let $A = \{a, b, c, d, e\}$, For the following relation R on A , determine whether or not R is an equivalence relation?

$R = \{(a, b), (b, a), (b, d), (d, a), (c, e), (e, c), (e, e)\}$.

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Q3 (c): Let f, g and h be functions $\mathbb{R} \rightarrow \mathbb{R}$ defined respectively by

$f(x) = 2x + 1, \quad g(x) = 1/(x^2 + 1), \quad \text{and} \quad h(x) = \sqrt{x^2 + 1}$

Find the following:

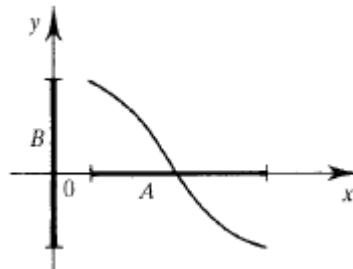
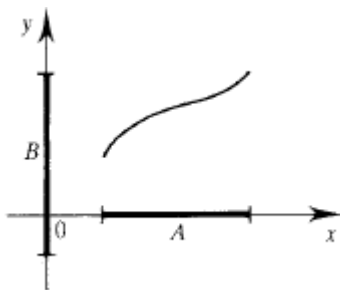
(i) $(g \circ f)(1)$

(ii) $(f \circ g)(2)$

(iii) $(f \circ g \circ h)(x)$

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Q3 (d): The graphs of two functions $A \rightarrow B$ are given below. Determine whether or not each function is injective and/or surjective:



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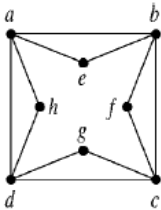
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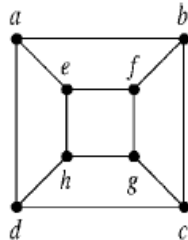
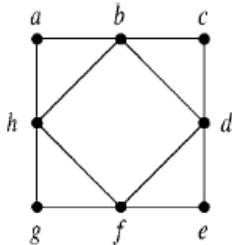
Fourth Question

(16)

Q4 (a): Draw a spanning tree for the following graph:



Q4 (b): Are the following graphs isomorphic? Explain your answer:



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Q4 (c): the following matrix is an adjacency matrix of a graph. Determine whether the corresponding graph is Eulerian or not:

$$\begin{pmatrix} 1 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 2 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 2 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 \end{pmatrix}$$

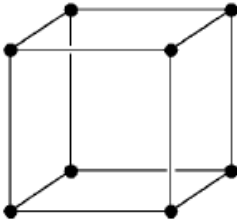
Q4 (D): draw the complete bipartite graph K3,4

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Q4 (E): is the graph shown below Hamiltonian? (Explain your answer)



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Fifth Question (Bonus)

3 Bonus Marks

Test the validity of the following arguments:

“If there are clouds in the sky then the sun doesn’t shine and if the sun doesn’t shine then the temperature falls. The temperature isn’t falling so there are no clouds in the sky”

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Good Luck