University of Palestine
Faculty of Applied Engineering and Urban Planning

Course Name	Discrete Mathematics			Course No.	SWEN 2308
Academic Year	2018/2019	Semester	2nd	Exam Type	2st Midterm
Exam Date	18/04/2019			Exam Time	9am – 10am

اسم الطالب(بالعربي):			الرقم الجامعي:
اسم المدرس: د.م. أحمد حمدي أبو عبسة	رقم الشعبة:	وقت المحاضرة:	الرقم المتسلسل:

Important Instructions

- ***This is a closed-book exam; all related material must be placed away from your desk.***
- ***Cell phone use is prohibited for any purpose: Your cell phone must be turned off and placed off of the desk. Cell phones may not be accessed during the exam. Failure to comply may be treated as a violation of the Honor Code.***
- ***Headphones of any kind are not permitted.***
- ***This exam is 60 minutes long.***
- ***Make sure that you have 6 pages including this page.***
- ***This exam has 3 questions. Read each question carefully before answering.***
- ***Calculators are not permitted.***
- ***When you finish, you must:***
  - ***Check that you have written your information in the spaces provided.***
  - ***Give the exam package (all papers) to the proctor before you leave.***

For Teacher's Use Only

QN	KPI/ILO	SO	DL	Mark	Weight
1	B1	g	3		3
	B2	j	2		3
2	B1	b	3		2
	B2	i	4		4
	B3	a	1		2
	B4	g	3		2
	B5	j	2		3
3	B1	b	3		3
	B2	i	4		4
	B3	a	1		4
Total					**30**

For Proctor's Remarks

KPI: Key Performance Indicator, ILO: Intended Learning Outcomes, SO: ABET Student Objectives, DL: Difficulty Level (1. Very easy, 2. Easy, 3. Moderate, 4. Somewhat hard, 5. Hard, 6. Very Hard)

Q1: **The Foundations: Logic and Proofs**

B1: Use the rules of inference to show that:

1. $\forall x \left(\left(p(x) \vee Q(x)\right) \rightarrow R(x)\right)$
2. $\forall x \left(R(x) \rightarrow S(x)\right)$
3. $\exists x(\neg S(x) \wedge T(x))$

Imply $\exists x \neg P(x)$

B2: Use set builder notation and logical equivalence to show that

(A-B)-C=(A-C)-B

Q2: **Basic Structures: Sets, Functions, Sequences, Sums, and Matrices**

B1. Find the power set of {a,b,{a,b}}

B2. For $A_i = [-i, i]$ where i is a positive integer,

i. Find $\bigcup_{i=1}^{\infty} A_i$

ii. Find $\bigcap_{i=1}^{\infty} A_i$

B3. Let A = {a, b, c}, B = {x, y}, and C = {0, 1}.

Find $A \times C \times B$.

B4. Draw the Venn diagram for $\overline{A} \cap \overline{B} \cap \overline{C}$

B5. Solve the following equations using the inverse matrix method

$$x + y = 5$$
$$3x - 2y = 5$$

Q3: **Counting**

B1: Show that there are at least six people in California (population: 37 million) with the same three initials who were born on the same day of the year (but not necessarily in the same year). Assume that everyone has three initials.

B2: A coin is flipped 10 times where each flip comes up either heads or tails. How many possible outcomes
a) are there in total?

b) contain exactly two heads?

c) contain at most three tails?

d) contain the same number of heads and tails?

B3: Compute the following summation:

$$\sum_{i=7}^{10}\sum_{j=1}^{8}\left(2^j - j(3^i)\right)$$

Some Useful Formulas

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2} \quad , \quad \sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6} \quad , \quad \sum_{i=1}^{n} i^3 = \left(\frac{n(n+1)}{2}\right)^2$$

$$\sum_{i=0}^{n} a^i = \frac{a^{n+1}-1}{a-1} \text{ where } a \neq 1 \quad , \quad \sum_{i=0}^{\infty} a^i = \frac{1}{1-a} \text{ where } |a| < 1,$$

$$\sum_{i=1}^{\infty} i a^{i-1} = \frac{1}{(1-a)^2} \text{ where } |a| < 1$$

$p \to (p \vee q)$	Addition	$[\neg q \wedge (p \to q)] \to \neg p$	Modus Tollens
$(p \wedge q) \to p$	Simplification	$[(p \to q) \wedge (q \to r)] \to (p \to r)$	Hypothetical syllogism
$((p) \wedge (q)) \to (p \wedge q)$	Conjunction	$[(p \vee q) \wedge \neg p] \to q$	Disjunctive syllogism
$[p \wedge (p \to q)] \to q$	Modus Ponens	$[(p \vee q) \wedge (\neg p \vee r)] \to (q \vee r)$	Resolution

End of Questions