First Semester 1442 AH (Fall 2020)
Midterm Examination: Sun 25.10.2020 C.E. (Time: 6-7:30 pm)
Instructor: Prof. Aqil Azmi and Dr Yousef Al-Ohali

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1. [Marks 15]

Let the sets $A = \{a, \{b, c\}\}$, and $B = \{\{b\}, c\}$. Calculate the following, where $P(\square)$ is the power set of $\square$

(a)	$A \cup B =$
(b)	$A \cap B =$
(c)	$\left\|P(A \cup B)\right\| =$
(d)	$P(A \cap B) =$

2. [Marks 15]

Let $P(x, y)$ be the statement "$x + y > 0$". What are the truth values of the following quantification (do not mention the reason). Assume the universe of discourse (domain) is $\mathbb{Z}$.

a	$\forall x \forall y P(x, y)$	
b	$\forall x \exists y P(x, y)$	
c	$\exists x \exists y P(x, y)$	
d	$\exists x \forall y P(x, y)$	

3. [Marks 10]

Find the prime factorization of the number 318109.

4. [Marks 15]

Let R(x) = "student x registered for CSC281", and P(x) = "student x passed CSC281". Assume the universe of discourse all the students in the college. Express the following statements using R(x), P(x) and the quantifiers.

a. Ahmad registered for CSC281.

b. Every student who registered CSC281 passed it.

c. Some students who registered CSC281 but did not pass it.

5. [Marks 15]

Evaluate the summation,

$$\sum_{i=1}^{n}\sum_{j=1}^{m} n^{i}$$

6. [Marks 10]

Consider the sequence: $a_{61} = 258, a_{62} = 261, a_{63} = 264, \ldots$ Calculate the sum $\sum_{k=100}^{150} a_k$. Show your steps.

7. **[Marks 10]**

Suppose that $A = \{1, 2\}, B = \{x, y\}$ be sets. Let f be a function, $f : A \to B$. Draw *all* the possible functions f and mark their type (one-one, onto, ...).

8. [Marks 10]

Prove that if $n^2 + 1$ is odd, then n is even. What proof method you used?