King Fahd University of Petroleum and Minerals

College of Computer Science and Engineering

ICS 253 Section 01

Major Exam 2

26 November 2015

Student Name: _____ Student ID: _____

Learning Objective	Question	Total Marks	Acquired Marks	Notes
2	1	10		
2&3	2	10		
2&3	3	10		
2&3	4	10		
2	5	10		
2	6	10		
	Total	**60**		

Notes:

1) Write your Student ID on the top of each paper sheet.
2) This exam contains six different paper sheets **excluding** this cover page.
3) Answer all questions in this exam.
4) Exam duration is 60 minutes.

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Question 1

The symmetric difference of two sets A and B, denoted by $A \oplus B$, is the set containing those elements in either A or B, but not in both A and B.

a) Using set builder notation show that $A \oplus B = (A \cup B) - (A \cap B)$

b) Show that $A \oplus A = \emptyset$

Question 2

a) Prove that $(0,1)$ and $[0,1]$ have the same cardinality.

b) How many bit string of length 10 contain at least three 1s and at least three 0s? [Show the steps to count the bit strings. A single number will not be accepted as an answer]

Question 3

a) Prove that the derivative of $f(x) = x^n$ equals nx^{n-1} whenever n is a positive integer.

c) How many bit string of length 10 either begin with three 0s or end with two 0s? [Show the steps to count the bit strings. A single number will not be accepted as an answer]

Question 4

a) Let f be a function from S to T, where S and T are nonempty finite sets. Furthermore, let $|S| > |T|$. What is the least number of elements of S that are mapped to the same element of T? [Justify your answer]

b) How many ways are there to arrange the letters *a*, *b*, *c*, and *d* such that *a* is not followed immediately by *b*? [Show the steps to count the bit strings. A single number will not be accepted as an answer]

Question 5

Show that among any $n + 1$ positive integers not exceeding $2n$ there must be an integer that divides one of the other integers.

Question 6

If the set S is defined as follows:

- $3 \in S$
- If $x \in S$ and $y \in S$ then $x + y \in S$

Then prove that S is the set of all positive integers that are multiple of 3.