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

Q9 Page 421

What is the coefficient of $x^{101}y^{99}$ in the expansion of $(2x - 3y)^{200}$?

ANSWER: $-2^{101}3^{99}\binom{200}{99}$

Ex 5 Page 426

How many solutions are there to the equation $x_1 + x_2 + x_3 = 11$, where x_i is a nonnegative integers?

ANSWER: $C(3 + 11 - 1,11) = C(13,11) = C(13,2) = \frac{13 \times 12}{1 \times 2} = 78$

Ex 5 Page 448

Find the probability that a hand of five cards in poker contains four cards of one kind

ANSWER: $\frac{C(13,1)C(4,4)C(48,1)}{C(53,5)} = \frac{13 \times 1 \times 48}{2,598,960} \approx 0.00024$

Q7 Page 510

Find a recurrence relation for the number of bit string of length n that contains a pair of consecutive 0s and mention the initial conditions.

ANSWER: $a_n = a_{n-1} + a_{n-2} + 2^{n-2}$ for $n \geq 2$ with $a_0 = 0$ and $a_1 = 0$

Question

Classify the following recurrence relation: $a_n = 3a_{n-5} + 4a_{n-2}$

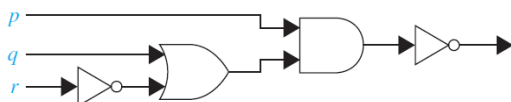ANSWER: Linear, Homogeneous, Constant coefficients, Degree 5

Q3a Page 549

Write the generating function for the following finite sequence in the closed form:
0, 2, 2, 2, 2, 2, 2, 0, 0, 0, …

ANSWER: $f(x) = \frac{2x(1-x^6)}{(1-x)}$

Q41a Page 24

Find the output of the following combinatorial circuit:

ANSWER: ¬(p ∧ (q ∨ ¬r))

Q9c Page 1.3

Show that $\neg p \rightarrow (p \rightarrow q)$ is a tautology using the truth table

ANSWER:

p	q	$\neg p$	$p \to q$	$\neg p \to (p \to q)$
T	T	F	T	T
T	F	F	F	T
F	T	T	T	T
F	F	T	T	T

Q29c Page 67

Suppose that the domain of the propositional function $P(x, y)$ consists of pairs x and y, where x is 1, 2, or 3 and y is 1, 2, or 3. Write out $\exists x \forall y P(x, y)$ using disjunctions and conjunctions.

ANSWER:
  $[P(1,1) \wedge P(1,2) \wedge P(1,3)] \vee [P(2,1) \wedge P(2,2) \wedge P(2,3)] \vee [P(3,1) \wedge P(3,2) \wedge P(3,3)]$

Q19b Page 79

Determine whether the following argument is valid. If so, what rule of inference is being used? If not, what logical error occurs?

If n is a real number with $n > 3$, then $n^2 > 9$.
Suppose that $n^2 \leq 9$. Then $n \leq 3$.

ANSWER: Fallacy of begging the question