KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS & STATISTICS
DHAHRAN, SAUDI ARABIA

STAT 301: Introduction to Probability Theory
Semester 172, Final Exam
Wednesday May 09, 2018 (8:00 am)

Name: ID #:

Question No	Full Marks	Marks Obtained
1	**09**	
2	**12**	
3	**07**	
4	**12**	
5	**10**	
6	**10**	
Total	**60**	

Instructions:

1. Mobiles are not allowed in exam. If you have your **mobile** with you, **turn it off** and put it **under your seat** so that it is visible to proctor.

2. Show all the calculation steps. There are points for the steps so if your miss them, you would lose points.

3. If you use any **formula/rule/theorem** that is not in the formula sheet, mention it clearly in your solution.

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Q.No.1: - (9 points) A special 5 sided die is designed with numbers from 1 to 5 written on each side such that the probability of an odd number appearing is twice as the probability of an even number. The die is continually rolled until the total sum of all rolls exceeds 300. Approximate the probability that at least 80 rolls are necessary.

Q.No.2: - (5+4+3=12 points) Suppose X is uniformly distributed over $[0,1]$ and Y is uniformly distributed over $\left[0, \frac{1}{2}\right]$. Assume that X and Y are independent.

(a) Derive the joint *pdf* of $U = X + Y$ and $V = \frac{X}{Y}$.

(b) For the joint *pdf* found in (a), find the domain in terms of u and v.

(c) Show that the joint *pdf* from part (a) is valid over the domain from part (b).

Q.No.3: - (2+5 = 7 points) An auto insurance company insures an automobile worth 5,000 SR for one year. If there is partial damage to the car, the amount X of damage (in thousands) follows a distribution with the following density function:

$$f(x) = \frac{x}{2}; \qquad 1 < x < k$$

(a) Find the value of constant k.

(b) A random sample of 5 claims is selected. Find the probability that the minimum damage (out of those 5 claims) is at least 1500.
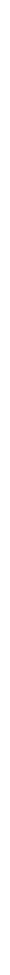
Q.No.4: - (5+7 = 12 points)

(a) Families enter a play land at a rate of 1 every 2 minutes. What is the probability that at least 3 families enter the play land during 9:00 PM and 9:05 PM?

(b) What is the probability that in the next year, at least 3 families enter the play land during 9:00 PM and 9:05 PM on fewer than 160 days.

Note: Consider 365 days in a year.

Q.No.5: - (10 points) Suppose that Ali and Hassan are students of STAT301. Their instructor believes that the expected score of Ali is 70 with a standard deviation of 4. For Hassan, the instructor believes that his expected score is 85 with a standard deviation of 5. Assume that the scores of both students are independent. What can you say about the probability that "Ali will score less than Hassan and the difference between their points will be between 5 and 25"?

Q.No.6: - (4+6 = 10 points)

(a) A total of 28 percent of American males smoke cigarettes, 7 percent smoke cigars and 5 percent smoke both cigar and cigarettes.

(i) What percent of males smokes neither cigars nor cigarettes?

(ii) What percent smokes cigars but not cigarettes?

(b) Twelve percent of all U.S. households are in California. A total of 1.3 percent of all U.S households earn more than $250,000 per year, while a total of 3.3 percent of all California households earn more than $250,000 per year. Given that a randomly chosen U.S. household earns more than $250,000 per year, what is the probability it is a California household?

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Best of Luck