UNIVERSITY OF MINES AND TECHNOLOGY. TARKWA

FIRST SEMESTER EXAMINATIONS, NOV 2018

COURSE NO: EL/CE/MC 361
COURSE NAME: PROBABILITY AND STATISTICS
CLASS: EL/CE/MC III **TIME:** 3 HOURS

Name**:** _____Index Number: _____

ANSWER ANY THREE QUESTIONS

QUE 1

(a) A fair dice is tossed twice until a sum of seven appears for the first time.

i. What is the probability that more than four tosses will be required for the sum of seven to happen?

ii. Find the expected number of tosses.

(b) An underground military installation is fortified to the extent that it can withstand up to three direct hits from air-to-surface missiles and still function. Suppose an enemy aircraft is armed with missiles, each having a 30 % chance of scoring a direct hit.

i. What is the probability that the installation will be destroyed with the seventh missile fired is obtained by fewer than nine air strikes?

ii. Find the expected air-to-surface missiles strike.

QUE 2

(a) A door-to-door encyclopedia salesperson is required to document five in-home visits each day. Suppose that she has a 30% chance of being invited into any given home, with each address representing an independent trial.

i. What is the probability that she requires fewer than eight houses to achieve her fifth success?

(b) It is known from experience that 1.4 percent of the calls received by a switchboard are wrong numbers.

ii. What is the probability that among 150 calls received by the switchboard 2 are wrong numbers?

QUE 3

(a) Among 25 silver dollars struck in 1903 there are 15 from Philadelphia mint, 7 from the New Orleans mint, and 3 from the San Francisco mint. If 5 of these silver dollars are picked at random

i. Find the probability of getting 4 from the Philadelphia mint and 1 from the New Orleans mint.

(b) As part of an air-pollution survey, an inspector decides to examine the exhaust of 6 of a company's 24 trucks. If 4 of the company's trucks emit excessive amounts of pollutants

ii. What is the probability that none of them will be included in the inspector's sample?

QUE 4

(a) Given a standard normal distribution, find the value of k such that

i. $P(Z > k) = 0.3015$, and

ii. $P(k < Z < -0.18) = 0.4197$

(b) The Department of Energy (DOE) put projects out on bid and generally estimates what a reasonable bid should be. Call the estimate b. The DOE has determined that the density function of the winning (low) bid is

$$f(y) = \begin{cases} \frac{5}{8b}, & \frac{2}{5}b \le y \le 2b, \\ 0, & \textit{elsewhere.} \end{cases}$$

Find:

i. The Cumulative Distribution Function, $F(y)$.

ii. Determine the probability that the winning bid is less than the DOE's preliminary estimate b.

QUE 5

Water consumption, expressed in gallons per capita per day, is a major concern to city administrators in a growing desert city. To address the problem comprehensively, 10 cities of different population size in the Southwest was studied as shown below:

CITY	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
$(\mathbf{x}_i \times 10^5)$	0.5	1.0	2.0	2.5	3.0	4.0	5.0	6.0	7.0	8.0
$\mathbf{y}_i$	100	110	110	113	125	130	130	145	155	150

where X denotes the population size and Y denotes the water consumption in gallons per capita per day.

i. Determine the regression equation of $\mathbf{y}$ on $\mathbf{x}$.

ii. Determine the conditional standard deviation.

iii. Determine the coefficient of determination.

iv. Suppose the population of the city will be 75 000 in 2010. If the water consumption corresponding to a given population is a normal random variable, what is the probability that the per capita water consumption will exceed 150 gallons per day?

***Examiner: P. Boye** / L. Brew*