KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICAL SCIENCES
DHAHRAN, SAUDI ARABIA

STAT 319: PROBABILITY & STATISTICS FOR ENGINEERS & SCIENTISTS

Major Examination No. 1, Term 121

Time: 18: 00- 19:30 PM, Tuesday, 25th October, 2012

Please Check/circle the name of your instructor; Write section number and serial number in the top left corner of this booklet or below:

Section # /Serial #   ID#

Name in Capital Letters: KEY

Instructors: □ Anabosi   □Joarder
                    □ Malik

Coordinator: Anwar Joarder

You are allowed to use electronic calculators and other reasonable writing accessories that help write the exam. Try to define events, formulate problem and solve. See example below.

Do not keep your **mobile** with you during the exam, turn off your mobile and leave it aside.

No	Marks	Marks Obtained	Strengths and Weakness Observed
1	11		
2	4		
3	7		
4	3		
5	5		
Total	30		

Kindly report grade to the coordinator out of 15 so that students know his precise standing. You may assign fractional marks if deemed necessary.

1. A national chain of automobile oil-change franchises claims, "your hood will be open for less than 12 min. when we service your car." To check their claim, times (in minutes), denoted by x, are recorded of oil-change service for 26 randomly selected customers. The times are shown in the table below:

Customer number	1	2	3	4	5	6	7	8	9	10	11	12	13
Hood open time	10.2	10.4	10.6	11.2	11.5	11.8	11.5	11.3	12.8	12.5	12.7	12.8	12.4
Customer number	14	15	16	17	18	19	20	21	22	23	24	25	26
Hood open time	12.5	12.8	12.3	12.5	13.3	13.5	13.2	13.3	13.8	14.5	14.3	14.8	14.9

a. Complete the following table where f stands for frequency, F for cumulative frequency and n the sample size. (4 Marks)

x	f	f/n	F	F/n
[10, 11)	3	$3/26 = 0.115$	3	0.115
[11, 12)	5	$5/26 = 0.192$	8	0.307
[12, 13)	9	$9/26 = 0.346$	17	0.653
[13, 14)	5	$5/26 = 0.192$	22	0.845
[14, 15)	4	$4/26 = 0.154$	26	0.999
Total	26	1	No need	

b. Is the variable discrete or continuous? (1 Mark)

① Continuous, because it is measured to seconds.

c. Calculate the mean, median and mode of the time hood is open. (6 Marks)

The sorted data is:

10.2   10.4   10.6   11.2   11.3   11.5   11.5   11.8   12.3   12.4   12.5   12.5   12.5

12.7   12.8   12.8   12.8   13.2   13.3   13.3   13.5   13.8   14.3   14.5   14.8   14.9

$$\Rightarrow \sum_{1}^{26} x = 327.4 \qquad \Rightarrow \bar{x} = \frac{\sum x}{26} = \frac{327.4}{26} = \boxed{12.592} \text{ min}$$

$$\Rightarrow \tilde{x} = \frac{x_{(13)} + x_{(14)}}{2} = \frac{12.5 + 12.7}{2} = \boxed{12.6} \text{ min}$$

$\Rightarrow$ Two modes are $\boxed{\begin{array}{c} 12.5 \\ 12.8 \end{array}}$ with freq. of 3 & " " " .

2. As a result of government and consumer pressure, automobile manufacturers in the US are deeply involved in research to improve their product's gasoline mileage. One manufacturer hoping to achieve 40 miles per gallon on one of its compact models, measured the mileage (x_i) obtained by 11 test versions of the model with the following results:

30	31	32	33	34	35
36	37	38	39	40	

Complete the following table:

x_i	$\bar{x}$	$x_i - \bar{x}$	$(x_i - \bar{x})^2$
30	35	-5	25
31		-4	16
32		-3	9
33		-2	4
34		-1	1
35		0	0
36		1	1
37		2	4
38		3	9
39		4	16
40		5	25
		0	110

a. Calculate $\sum_{i=1}^{11}(x_i - \bar{x})$. (2 Marks)

$$\sum(x_i - \bar{x}) = 0 \quad (1)$$

$$, \bar{x} = \frac{\sum x_i}{11} = \frac{385}{11} = 35$$

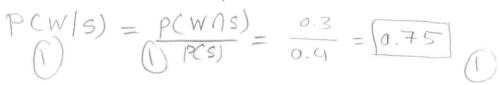b. Calculate $s_{xx} = \sum_{i=1}^{11}(x_i - \bar{x})^2$. (2 Marks)

$$s_{xx} = 110 \quad (1)$$

3. Suppose that of all individuals buying a certain personal computer, 60% include a word processing (W) program in their purchase, 40% include a spreadsheet (S) program, and 30% include both types of programs. We are interested in knowing the inclusion of the programs.

a. Write out the sample space for the problem. (1 Mark)

$$P(S) = 0.4 \quad , \quad P(W) = 0.6 \quad , \quad P(S \cap W) = 0.3$$

$$S = \{ SW, S\bar{W}, \bar{S}W, \bar{S}\bar{W} \}$$

	S	$\bar{S}$	
W	0.3	0.3	0.6
$\bar{W}$	0.1	0.3	0.4
	0.4	0.6	

b. Find the probability that a word processing program was included given that the selected individual was included a spreadsheet program. (3 Marks)

$$P(W/S) = \frac{P(W \cap S)}{P(S)} = \frac{0.3}{0.4} = \boxed{0.75}$$

c. Are the events "word processing program was included" (W) and the event "selected individual was included a spreadsheet program" (S) independent? (3 Marks)

$$P(w/s) = 0.75 \quad , \quad P(W) = 0.6$$

Since $P(w/s) \neq P(W) \implies$ W & S are Dependent

or

$$P(S \cap W) = 0.3$$

$$P(S) \cdot P(W) = (0.4)(0.6) = 0.24$$

Since $P(S \cap W) \neq P(S) \cdot P(W) \implies$ W & S are D......

4. A box contains 6 pens of which 4 are dried.

a. Two pens are selected one after another without replacement. What is the probability that one of them is dried and one has ink? (2 Marks)

Let $D : Dry$, $I : Ink$.

$$P(1D, 1I) = \frac{{}_4C_1 \cdot {}_2C_1}{{}_6C_2} \text{ ①} = \frac{4 \times 2}{15} = \boxed{\frac{8}{15}} \text{ ①}$$

Another solution: $P(1D, 1I) = P(DI) + P(ID)$. ①

$$= \frac{4}{6} \cdot \frac{2}{5} + \frac{2}{6} \cdot \frac{4}{5} \text{ ①}$$

$$= \frac{8}{30} + \frac{8}{30} = \frac{16}{30} = \boxed{\frac{8}{15}} \text{ ①}$$

b. The pens are selected at random one by one until a good pen is selected. The sequence of test results is noted. What is the sample space? (1 Mark)

$$S = \{ I, DI, DDI, DDDI, DDDDI \}$$

①

5. A chemical engineer keeps repeating an experiment unless he gets the desired result (S) with the restriction that the lab supervisor allows him to repeat an experiment a maximum of 3 times. It is estimated that the probability of getting the desired result in any experiment at a time is 0.75.

a. Write out the sample space? (2 Marks)

$$S = \{ S, FS, FFS, FFF \} \quad ①$$

$$P(S) = 0.75, \quad P(F) = 1 - P(S) = 0.25$$
$$= \frac{3}{4} \qquad\qquad\qquad = \frac{1}{4}$$

x	0	1	2	3	Total
$p(x)$	$\frac{48}{64}$	$\frac{12}{64}$	$\frac{3}{64}$	$\frac{1}{64}$	$\frac{64}{64}$

b. What is the probability that he repeats the experiment 3 times? (3 Marks)

$$P(\text{Repeat } 3 \text{ times}) = P(FFS) + P(FFF) \, ①$$

$$= P(F)^2 \cdot P(S) + P(F)^3 \, ①$$

$$= \left(\frac{1}{4}\right)^2 \left(\frac{3}{4}\right) + \left(\frac{1}{4}\right)^3$$

$$= \frac{3}{64} + \frac{1}{64} = \boxed{\frac{4}{64}} \, ①$$