Name:_____

$I\ D$ $N\ O$	:							$0\ 1$ $8\ am$	$0\ 3$ $9\ am$	$0\ 5$ $10\ am$	$0\ 2$ $1\ pm$

$Time$ $100Min$	$Seat\ :$ $No.\ :$				$Marks$ 90	$Marks\ :$ $Secured\ :$			

NOTE: 1. The questions are not in any order of difficulty at all.

2. All questions carry equal number of marks.

3. Only the nonprogramable calculators are allowed.

4. All types of PAGERS, OR MOBILES ARE NOT ALLOWED to be with you during the examination.

5. Use an HB 2 pencil.

6. Use a good eraser. Do not use the eraser attached to the pencil.

7. Write your name, ID number and Section number on the examination paper and in the upper left corner of the answer sheet.

8. When bubbling your ID number and Section number, be sure that bubbles match with the number that you write.

9. The test Code Number is already typed and bubbled in your answer sheet. Make sure that it is the same as that printed on your question paper.

10. When bubbling, make sure that the bubbled space is fully covered.

11. When erasing a bubble, make sure that you do not leave any trace of penciling.

12. Count that the exam has EIGHTEEN Questions and TEN Pages.

13. Please BUBBLE carefully only right answer letter (A or B or C or D or E) corresponding to the correct answer to each question in the enclosed computerized Omar Sheet, with pencil only.

14. Please do not leave any question unbubbled in the Answer Sheet.

15. Please check that the version of your question paper and the answer sheet enclosed with it matches correctly. The versions are $001,\ 002,\ 003,\ 004$.

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Compound Interest Formulae: $S = P(1+r)^n$, $P = A(1+r)^{-n}$. Effective Interest Formula: $r_e = \left(1+\frac{r}{n}\right)^n - 1$.

Continuos Interest Formula: Present $P = Ae^{-rt}$, Effective Interest Formula: $r_e = e^r - 1$.

Ordinary Annuity Formulae (End): Future Value = $S = R.\left[\frac{(1+r)^n - 1}{r}\right]$.

Present Value: $A = R.\left[\frac{1-(1+r)^{-n}}{r}\right]$.

Annuity Due Formulae (Beginning): Future Value = $S = R.\left[\frac{(1+r)^{n+1}-1}{r} - 1\right]$.

Present Value = $A = R.\left[1 + \frac{1-(1+r)^{-n+1}}{r}\right]$.

${}^nP_r = \frac{n!}{(n-r)!}$; $\left(\begin{array}{c} n \\ r \end{array}\right) = {}^nC_r = \frac{n!}{r!\,(n-r)!}$.

$\#(A \cup B) = \#(A) + \#(B) - \#(A \cap B)$

Pr$obability$ Laws: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

Conditional Probability: $P(A/B) = \frac{P(A \cap B)}{P(B)}$.

Events A and B are Independent $\Longleftrightarrow$ $P(A \cap B) = P(A)P(B) \iff P(A/B) = P(A) \Longleftrightarrow P(B/A) = P(B)$.

BINOMIAL DISTRIBUTION: $P(X = x) = \left(\begin{array}{c} n \\ x \end{array}\right) p^x q^{n-x}$; $x = 0,\ 1,\ 2,\ 3,\ 4,\ \ldots, n$; $q = 1-p$. Mean $= \mu = np$; $Var(X) = \sigma^2 = npq$.

1Q1. 40Rolf49. The profit function is revenue minus cost; that is,

$P(x) = R(x) - C(x)$.

The weekly expenses of selling x bicycles in the Bike Shop are given by the cost function:

$C(x) = 1200 + 130x$

and revenue is given by:

$R(x) = 210x$.

Then the profit from selling 18 bicycles is:

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	1440	
$B \longrightarrow$	1140	
$C \longrightarrow$	2340	
$D \longrightarrow$	240	
$E \longrightarrow$	1200	

2Q2. 73Rolf53.

The Kiwanis Club sold citrus fruit to raise money for the scholarship fund. A box of oranges cost $\$\ 14$ and a box of grapefruit cost $\$\ 16$. They sold 502 boxes of citrus for a total of $\$\ 7570$.

Let $x =$ number of boxes of oranges

and $y =$ number of boxes of grapefruit.

Then the difference of y and x is given by: $y - x =$

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	60	
$B \longrightarrow$	50	
$C \longrightarrow$	40	
$D \longrightarrow$	30	
$E \longrightarrow$	20	

3Q3. 9LH52. Given the following revenue and cost functions, determine for which values of x a loss will occur.

(Recall the profit equals revenue minus cost.)

$R(x) = 100x - 2x^2$;

$C(x) = 20x + 800$.

(Useful Hint: For any $ab > 0 \Longrightarrow a > 0$ & $b > 0$ OR $a < 0$ & $b < 0$).

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	$x > 10$ or $x < 10$	
$B \longrightarrow$	$x > 20$ or $x < 20$	
$C \longrightarrow$	$x > 40$ or $x < 40$	
$D \longrightarrow$	$x > 80$ or $x < 80$	
$E \longrightarrow$	$x > 100$ or $x < 100$	

4Q4. 256SM51. Optimal Land Use. A farmer has 1000 acres of land on which corn, wheat, or soybeans can be grown.

Each acre of corn costs $\$\ 100$ for preparation, requires 7 days of labor, and yields a profit of $\$\ 30$.

An acre of wheat costs $\$\ 120$ to prepare, requires 10 days of labor, and yields $\$\ 40$ profit.

An acre of soybeans costs $\$\ 70$ to prepare, requires 8 days of labor, and yields $\$\ 40$ profit.

Suppose the farmer has $\$\ 10000$ for preparation and can count on enough workers to supply 8000 days of labor.

Let x represent the acres of corn, let y represent the acres of wheat, and let z represent the acres of soybeans.

Set up the linear programing problem by writing the constraints in the form of a system of linear inequalities to maximize the profit function $P = 30x + 40y + 40z$ without solution.

$$A.\begin{cases} x + y + z \geq 1000 \\ 100x + 120y + 70z \geq 10000 \\ 7x + 10y + 8z \geq 8000 \\ x \geq 0,\ y \geq 0,\ z \geq 0 \end{cases}$$

$$B.\begin{cases} x + y + z \leq 1000 \\ 100x + 120y + 70z \geq 10000 \\ 7x + 10y + 8z \leq 8000 \\ x \geq 0,\ y \geq 0,\ z \geq 0 \end{cases}$$

$$C.\begin{cases} x + y + z \leq 1000 \\ 100x + 120y + 70z \leq 8000 \\ 7x + 10y + 8z \leq 10000 \\ x \geq 0,\ y \geq 0,\ z \geq 0 \end{cases}$$

$$D.\begin{cases} x + y + z \geq 1000 \\ 100x + 120y + 70z \geq 10000 \\ 7x + 10y + 8z \geq 8000 \\ x \geq 0,\ y \geq 0,\ z \geq 0 \end{cases}$$

$$E.\begin{cases} x + y + z \leq 1000 \\ 100x + 120y + 70z \leq 10000 \\ 7x + 10y + 8z \leq 8000 \\ x \geq 0,\ y \geq 0,\ z \geq 0 \end{cases}$$

5Q.5. 81SM74. Production.

The manufacturer of an automobile requires painting, drying, and polishing.

The Rome Motor Company produces three types of cars: the Centurion, the Tribune, and the Senator.

Each Centurion requires 8 hours for painting, 2 hours for drying, and 1 hour for polishing.

A Tribune needs 10 hours for painting, 3 hours for drying, and 2 hours for polishing.

It takes 16 hours of painting, 5 hours of drying, and 3 hours of polishing to prepare a Senator.

If the company uses 240 hours for painting, 69 hours for drying, and 41 hours for polishing in a given month, how many of each type of car are produced?

Let $x =$ number of Centurion,

$y =$ number of Tribune,

$z =$ number of Senator.

Set up the system of linear equations without solution.

$$A.\begin{cases} 8x + 2y + z = 240 \\ 10x + 3y + 2z = 69 \\ 16x + 5y + 3z = 41 \end{cases}$$

$$B.\begin{cases} 8x + 10y + 16z = 240 \\ 2x + 3y + 5z = 69 \\ x + 2y + 3z = 41 \end{cases}$$

$$C.\begin{cases} 8x + 16y + 10z = 240 \\ 2x + 5y + 3z = 69 \\ x + 3y + 2z = 41 \end{cases}$$

$$D.\begin{cases} 8x + 10y + 16z = 41 \\ 2x + 3y + 5z = 69 \\ x + 2y + 3z = 240 \end{cases}$$

$$E.\begin{cases} 16x + 10y + 8z = 240 \\ 3x + 2y + 5z = 69 \\ x + 3y + 2z = 41 \end{cases}$$

6Q.6. 179SM27. Use the Geometric Method to find the Maximum Value M and the Minimum Value m of $Z = 2x + 3y$ subject to the given constraints:

$$\begin{cases} x + y \geq 2 \\ x + 3y \leq 12 \\ 3x + y \leq 12 \\ x \geq 0,\ y \geq \geq 0 \end{cases}$$

Then $M + m =$

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	19	
$B \longrightarrow$	21	
$C \longrightarrow$	28	
$D \longrightarrow$	40	
$E \longrightarrow$	42	

7Q.7. 103LH8C14TB.

Use the Simplex Method to solve the standard linear programing problem.

Maximize: $Z = x_1 + 3x_2 + x_3$,

subject to constraints:

$$\begin{cases} 4x_1 + x_2 + x_3 \leq 372 \\ x_1 + 8x_2 + 6x_3 \leq 2978 \\ x_1 \geq 0 \ , \ x_2 \geq 0, \ x_3 \geq 0 \end{cases}$$

Initial Simplex Tableau:

$$\begin{bmatrix} 4 & 1 & 1 & 1 & 0 & 0 & : & 372 \\ 1 & 8 & 6 & 0 & 1 & 0 & : & 2978 \\ .. & .. & .. & .. & .. & .. & : & \cdots \\ -1 & -3 & -1 & 0 & 0 & 1 & : & 0 \end{bmatrix}$$

The Maximum Value of $Z =$

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	372	
$B \longrightarrow$	2232	
$C \longrightarrow$	2978	
$D \longrightarrow$	1488	
$E \longrightarrow$	1116	

8Q.8.41LH16TB. Assume that the sales of a certain appliance dealer are approximated by a linear function. Suppose that sales were $\$ \ 14000$ in 1982 and $\$ \ 46500$ in 1987.

Let $x = 0$ represent 1982.

Let y be the yearly sales, x years after 1982.

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	$y = 32500x + 14000$	
$B \longrightarrow$	$y = 32500x + 46500$	
$C \longrightarrow$	$y = 14000x + 32500$	
$D \longrightarrow$	$y = 6500x + 46500$	
$E \longrightarrow$	$y = 6500x + 14000$	

9Q.9.

The following nonlinear system of equations:

$x^2 + y^2 = 9$

$2x - y = 3$

has two solutions (x_1, y_1) and (x_2, y_2).

If $\alpha = x_1 + x_2$ and $\beta = y_1 + y_2$,

then we get:

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	$\alpha = \frac{12}{5}$ and $\beta = -\frac{6}{5}$	
$B \longrightarrow$	$\alpha = -\frac{6}{5}$ and $\beta = \frac{12}{5}$	
$C \longrightarrow$	$\alpha = -3$ and $\beta = \frac{9}{5}$	
$D \longrightarrow$	$\alpha = -\frac{12}{5}$ and $\beta = \frac{6}{5}$	
$E \longrightarrow$	$\alpha = 0$ and $\beta = -3$	

10Q.10. 105HB41. Age. Ten years ago a father was six times as old as his son.

Ten years from now he will be twice (two times) as old as his son.

Let $m =$ present age of father

and let $n =$ present age of his son.

Then the SUM of their ages $m + n =$

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	45	
$B \longrightarrow$	50	
$C \longrightarrow$	55	
$D \longrightarrow$	60	
$E \longrightarrow$	65	

11Q.11. 269HB19. Television call Letters. Television station call letters consist of either 3 or 4 letters and must begin with either K or W.

If there are no other restrictions, how many maximum number of call letters are possible ?

(Examples: $KLT, KWW, WTT, KKK,$ $KTK, WWW,$ KWWW, KKKK, WTWM, WKKK, KMMN, WKTT, KWYW, KABW, WECD, WXYZ, KAWZ, KYDT etc).

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	36504	
$B \longrightarrow$	35152	
$C \longrightarrow$	47525504	
$D \longrightarrow$	474552	
$E \longrightarrow$	28800	

12Q.12. 306HB5.2E. A survey of attitudes about one's job yields the data in the following table.

	Happy	Unhappy	Total
Bus drivers	50	75	125
Lawyers	40	35	75
Total	90	110	200

A person from this group is selected at random.

(a) Given that the selected person is a bus driver, find the probability p that he or she is happy.

(b) Find the probability q that he or she is happy.

Let $r = p + q$ be the sum of the two numbers p and q.

Then r is in the interval:

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	$[0.40, 0.60]$	
$B \longrightarrow$	$(0.60, 0.70]$	
$C \longrightarrow$	$(0.70, 0.80]$	
$D \longrightarrow$	$(0.80, 0.90]$	
$E \longrightarrow$	$(0.90, 1.00]$	

13Q.13. 115LH13TB.

238 students at a California school were interviewed with the following results:

89 spoke Spanish, 56 spoke French, and 12 spoke both languages.

Find the probability p that a randomly selected student from the group speaks neither Spanish nor French languages (He does not speak both languages Spanish and French). Then value of p is in the interval:

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	$(0.65, 0.80]$	
$B \longrightarrow$	$(0.50, 0.65]$	
$C \longrightarrow$	$(0.45, 0.50]$	
$D \longrightarrow$	$(0.40, 0.45]$	
$E \longrightarrow$	$(0.25, 0.40]$	

14Q.14. $358MS21$.A die is loaded so that

$P(1) = P(2) = P(3) = \dfrac{1}{4} = 0.25,$

$P(4) = P(5) = P(6) = \dfrac{1}{12}.$

Let $A = \{1, 2\}$, $B = \{2, 3\}$,

$C = \{3, 4\}$, $D = \{4, 5\}$, $E = \{5, 6\}$.

Then which one of the following statements is FALSE.

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	A and B are Independent.	
$B \longrightarrow$	A and C are Dependent.	
$C \longrightarrow$	C and D are Dependent.	
$D \longrightarrow$	A and E are Dependent.	
$E \longrightarrow$	D and E are Independent.	

15Q15. 359SM27. Recovery Rate. The recovery rate from a flu is 0.85.

If 4 people have the flu, what is the probability p (assume independence) that exactly two will recover and exactly two will not recover from flu?

The probability p is in the interval:

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	$(0.01, 0.05]$	
$B \longrightarrow$	$(0.05, 0.07]$	
$C \longrightarrow$	$(0.07, 0.09]$	
$D \longrightarrow$	$(0.09, 0.10]$	
$E \longrightarrow$	$(0.10, 0.50]$	

16Q.16. 333SM35. At the Milex tune-up and brake repair shop, the manager has found that a car will require a tune-up with a probability of 0.66, a brake job with a probability of 0.16, and both with probability of 0.05.

What is the probability p that a car requires either a tune-up or a brake job or both types of repair?

Then p is in the interval:

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	$(0.70, 0.74]$	
$B \longrightarrow$	$(0.74, 0.78]$	
$C \longrightarrow$	$(0.78, 0.82]$	
$D \longrightarrow$	$(0.82, 0.86]$	
$E \longrightarrow$	$(0.86, 0.90]$	

17Q.17. $243SM3E.$ (Ordinary Annuity). Mary decides to put aside $\$\ 100$ at the end of every month in an insurance fund that pays $8\ \%$ compounded monthly.

After making 8 monthly deposits (payments), how much money does Mary have?

The amount S after 8 months is in the interval:

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	$[800, 815]$	
$B \longrightarrow$	$(815, 820]$	
$C \longrightarrow$	$(820, 825]$	
$D \longrightarrow$	$(825, 830]$	
$E \longrightarrow$	$(830, 850]$	

18Q.18. 308TB11.3.11. If money earns interest at an annual rate of $8\ \%$ compounded continuously, then the present value (in dollars) of $\$\ 10000$ due at the end of five years is

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	$10000e^{-0.4}$	
$B \longrightarrow$	$10000e^{0.4}$	
$C \longrightarrow$	$\dfrac{e^{0.4}}{10000}$	
$D \longrightarrow$	$10000\,(1.08)^{5}$	
$E \longrightarrow$	$10000\,(1.08)^{-5}$	

Qn#	A	B	C	D	E	Marks
1				$\surd$		D
2			$\surd$			C
3		$\surd$				B
4					$\surd$	E
5		$\surd$				B
6	$\surd$					A
7					$\surd$	E
8					$\surd$	E
9	$\surd$					A
10			$\surd$			C
11	$\surd$					A
12				$\surd$		D
13				$\surd$		D
14					$\surd$	E
15				$\surd$		D
16		$\surd$				B
17		$\surd$				B
18	$\surd$					A
19						
20						
21						
22						
Sum						90