Booklet Code A

Entrance Examination (June 2012)

Master of Computer Applications (MCA)

Time: 2 Hours **Max. Marks: 100**

Hall Ticket Number:

INSTRUCTIONS

1. (a) Write your Hall Ticket Number in the above box AND on the OMR Sheet.

   (b) Fill in the OMR sheet, the **Booklet Code A** given above at the top left corner of this sheet. Candidates should also read and follow the other instructions given in the OMR sheet.

2. All answers should be marked clearly in the OMR answer sheet only.

3. This objective type test has two parts: Part A with 25 questions and Part B with 50 questions. Please make sure that all the questions are clearly printed in your paper.

4. Every correct answer in **Part A** carries **2 (two) marks** and for every wrong answer **0.66 mark** will be deducted.

5. Every correct answer in **Part B** carries **1 (one) mark** and for every wrong answer **0.33 mark** will be deducted.

6. Do not use any other paper, envelope etc for writing or doing rough work. All the rough work should be done in your question paper or on the sheets provided with the question paper at the end.

7. During the examination, anyone found indulging in copying or have any discussions will be asked to leave the examination hall.

8. Use of non-programmable calculator and log-tables is allowed.

9. Use of mobile phone is NOT allowed inside the hall.

10. Submit both the question paper and the OMR sheet to the invigilator before leaving the examination hall.

Y-8

Booklet code – A

Part A

1. The numbers 1 to 100 are written in a 10×10 grid. The multiples for each of the first few odd numbers — 3, 5, 7, 9, 11 and 13 — are coloured gray. The multiples of which number form a *continuous* line at 135° in the grid? Angles are measured in the conventional anti-clockwise way from the horizontal line given by the bottom row of the grid.

   A. 13

   B. 5

   C. 9

   D. 11

2. There is a vertical stack of books marked 1, 2, and 3 on Table A, with 1 at the bottom and 3 on top. These are to be placed vertically on Table B with 1 at the bottom and 2 on the top, by making a series of moves from one table to the other. During a move, the topmost book, or the topmost two books, or all the three, can be moved from one of the tables to the other. If there are any books on the other table, the stack being transferred should be placed on top of the existing books, without changing the order of books in the stack that is being moved in that move. If there are no books on the other table, the stack is simply placed on the other table without disturbing the order of books in it. What is the **minimum** number of moves in which the above task can be accomplished?

   A. One

   B. Two

   C. Three

   D. Four

3. A clock loses 1% time during the first week and then gains 2% time during the next one week. If the clock was set right at 12 noon on a Sunday, what will be the time that the clock will show exactly 14 days from the time it was set right?

   A. 1: 36: 48

   B. 1: 40: 48

   C. 1: 41: 24

   D. 10: 19: 12

4. A part of the divisibility test for 11 is: sum up alternate digits (starting from units place) and if the difference between them is 0, the number is divisible by 11. E.g., 1047673 gives $3 + 6 + 4 + 1$ (=14) and $7 + 7 + 0$ (=14), and therefore is divisible by 11. Now, sum up alternate *pairs* of digits (starting from units place) and if the difference between them is 0, then the number is divisible by X. E.g., 46662 gives 62 + 04 (=66) and 66, and therefore is divisible by X.

   What is X?

   A. 101

   B. 11

   C. 21

   D. 22

5. In any year, if April 1 is a Wednesday, then so is

   A. January 1

   B. July 1

   C. October 1

   D. December 1

Y – 8

Booklet code - A

6. If $(12*22*35)/p$ is an integer, which of the following CANNOT be the value of p?

   A. 15
   B. 21
   C. 28
   D. 50

7. There are two cubes on a table in which the volume of the second is half that of the first. If the first cube occupies a certain area (Y) on the table, how much area (approximately) does the second occupy?

   A. $\frac{Y}{\sqrt[3]{2}}$
   B. $\frac{Y}{2}$
   C. $\frac{Y}{\sqrt[3]{4}}$
   D. $\frac{Y}{\sqrt{2}}$

8. The age of a grandfather in years is the same as that of his grand-daughter's in months. If their ages differ by 55 years, the age of the grand-daughter is

   A. $5\frac{1}{2}$ yrs
   B. $5\frac{1}{2}$ months
   C. 5 years
   D. None of the above

9. Paper sizes are given by A0, A1, A2, etc. such that A0 is two times larger (in area) than A1, A1 is two times larger than A2 and so on. The longer dimension of each smaller size is equal to the shorter dimension of the larger size. For example, the longer dimension of A2 is the same as the shorter dimension of A1. In this scheme if A4 is 210 mm × 297 mm in size, what are the dimensions of A0 in mm?

   A. 840×594
   B. 420×594
   C. 840×1188
   D. None of the above

10. If $a, b \neq 0$,

$$\left(\frac{a}{b}\right)^{(x-1)} = \left(\frac{b}{a}\right)^{(x-3)},$$

   then $x =$

   A. 7/2
   B. 2
   C. 1
   D. 1/2

11. In a country with three major scooter manufacturers, Brand C sells three times as many as Brand A while Brand A sells half as many as Brand B. It implies that Brand C holds a market share of about

   A. 50%
   B. 33%
   C. 66%
   D. None of the above

12. On Planet X, a year has 400 days with a leap year of 401 days every 4 years. Also, a year ending in '00' is a leap year only if the year is divisible by 400, e.g. 2000 is a leap year but 3000 is not. Such a calendar is *exact* and needs no more corrections.

   The length of the year on Planet X is

   A. 400.2425 days
   B. 400.2475 days
   C. 400.25 days

Y-8

Booklet Code - A

D. None of the above

13. A gives B a start of 10 metres in a 100 metre race and still beats him by 1.25 seconds. How long does B take to complete the 100 metre race if A runs at the rate of 10 m/sec?

 A. 8 seconds

 B. 10 seconds

 C. 16.67 seconds

 D. 12.5 seconds

14. A large number of people die every year due to drinking polluted water during the summer.

 Given the two courses of action below, which of the answers **A ... D** is APPROPRIATE?

 I. The government should make adequate arrangements to provide safe drinking water to all its citizens.

 II. The people should be educated about the dangers of drinking polluted water.

 A. Both I and II follow

 B. Only I follows

 C. Only II follows

 D. Neither I nor II follows

15. Given that D is younger than F and older than G. A is younger than I and older than C. I is younger than G and older than J. J is younger than C and older than E. F is younger than B and older than H. H is older than D. The youngest of all of the above is

 A. E

 B. D

 C. A

 D. C

16. A military general needs to take his troop of 100 soldiers across a river from the bank A to bank B. He engages a boat with two boys, both of whom can row, at the bank A. But the boat can take only upto two boys or only one soldier. What is the *minimum number of round trips* that the boat has to make, to transfer all the 100 soldiers and the general to bank B and come back to bank A?

 A. 404

 B. 200

 C. 202

 D. 403

17. Mr.X lies only on saturday, sunday and tuesday and speaks only truth on the remaining days. On a particular day he said, "Today being a sunday, it is a rest day and tomorrow being a wednesday I will go to the market". What is the day on which this was spoken by Mr.X?

 A. Monday

 B. Tuesday

 C. Friday

 D. Saturday

18. Consider a number 23571113... made by placing in ascending order, all the prime numbers between 2 and 30. If this number were divided by 16, the remainder would be:

 A. 1

Y - 8

Booklet code - A

- Q: P is telling a lie
- R: I saw P stealing
- S: I am not the thief

A. P
B. Q
C. R
D. S

Y-8

Booklet code – A

Part B

26. Let $x = (2+\sqrt{3})^{2012}$ and f =fractional part of x. Then $x(1-f)$ is equal to

A. 1

B. 2

C. $2+\sqrt{3}$

D. 7

27. If the equation $x^4 - 4x^3 + ax^2 + bx + 1 = 0$ has four positive roots then $a = ?$ and $b = ?$

A. 6, -4

B. -6, 4

C. 6, 4

D. -6, -4

28. Find the point at which the line joining the points $A(3, 1, -2)$ and $B(-2, 7, -4)$ intersects the XY-plane.

A. (5, -6, 0)

B. (8, -5, 0)

C. (1, 8, 0)

D. (4, -5, 0)

29. Suppose $A = i - j - k, B = i - j + k$ and $C = -i + j + k$, where i, j, k are unit vectors. Pick the odd one out among the following:

A. $A \cdot (B \times C)$

B. $(A \times B) \cdot C$

C. $A \times C$

D. $A \times B$

30. Let α be an angle such that $0 < \alpha < \pi/2$ and $\tan(\alpha/2)$ is rational. Then which of the following is true?

A. Both $\sin(\alpha/2)$ and $\cos(\alpha/2)$ are rational

B. $\tan(\alpha)$ is irrational

C. Both $\sin(\alpha)$ and $\cos(\alpha)$ are rational

D. None of the above

31. Suppose the land use pattern of an educational institution in the year 2000 was 30% for educational buildings, 20% for residential purposes and 50% left as wilderness. Then the usage pattern has changed according to the transition probabilities every 5-years as given below:

$$\begin{pmatrix} Edu & Res & Wild \\ 0.1 & 0.1 & 0.8 \\ 0.2 & 0.2 & 0.6 \\ 0.3 & 0.2 & 0.5 \end{pmatrix}$$

Compute the land use pattern of educational buildings, residential purposes and wilderness in 2005 and then in 2010 respectively as percentages.

A. (22, 17, 61); (21.9, 17.6, 60.5)

B. (21, 17, 62);(21.9, 17.6, 60.5)

C. (21, 17, 62);(23.9, 17.8, 58.3)

D. (22, 17, 61); (23.9, 17.8, 58.3)

32. Consider the following equalities formed for any three vectors A, B and C.

I. $(A \cdot B)C = A(B \cdot C)$

II. $(A \times B) \times C = A \times (B \times C)$

III. $A \cdot (B \times C) = (A \times B) \cdot C$

IV. $A \times (B + C) = (A \times B) + (A \times C)$

Y-8

Booklet code- A

A. Only I is true

B. I, III and IV are true

C. Only I and IV are true

D. All are true

33. A particle moves on a coordinate axis with a velocity of $v(t) = t^2 - 2t$ m/sec at time t. The distance (in m) travelled by the particle in 3 seconds if it has started from rest is

A. 3

B. 0

C. $\frac{8}{3}$

D. 4

34. If $\frac{5\pi}{4} < \alpha < \frac{3\pi}{2}$, then

$$\sqrt{2\cot\alpha + \frac{1}{\sin^2\alpha}}$$

is equal to

A. $1 + \cot\alpha$

B. $1 - \cot\alpha$

C. $-1 - \cot\alpha$

D. $-1 + \cot\alpha$

35. The solution of the differential equation

$$\frac{d^3y}{dx^3} - 2\frac{d^2y}{dx^2} - \frac{dy}{dx} + 2y = 2x^2 - 2x - 4$$

A. $x^3 + c_1e^x + c_2e^{2x} + c_3e^{-2x}$

B. $x^2 + c_1e^x + c_2e^{2x} + c_3e^{-2x}$

C. $x^2 + c_1e^{-x} + c_2e^x + c_3e^{2x}$

D. $x^3 + c_1e^{-x} + c_2e^x + c_3e^{2x}$

36. Find the equation of the graph $xy = 1$ after a rotation of the axes by 45 degrees anti-clockwise in the new coordinate system (x', y').

A. $x'^2 - y'^2 = 1$

B. $(x'^2/2) - (y'^2/2) = 1$

C. $(x'^2/2) + (y'^2/2) = 1$

D. $(x'^2/\sqrt{2}) - (y'^2/\sqrt{2}) = 1$

37. The number of points (x, y) satisfying (i) $3x - 4y = 25$ and (ii) $x^2 + y^2 \leq 25$ is

A. 0

B. 1

C. 2

D. infinite

38. Let A be an $n \times n$ non-singular matrix over $\mathbb{C}$ where $n \geq 3$ is an odd integer. Let $a \in \mathbb{R}$. Then the equation

$$det(aA) = a\ det(A)$$

holds for

A. All values of a

B. No value of a

C. Only two distinct values of a

D. Only three distinct values of a

39. For any two positive integers a and b, define $a \equiv b$ if $(a - b)$ is divisible by 7. Then $(1526 + 128) \cdot (363) \cdot (645) \equiv$

A. 0

B. 3

C. 4

D. 5

40. The number of 1's in the binary representation of $13(16)^3 + 11(16)^2 + 9(16) + 3$ is

A. 7

B. 10

Y-8

Booklet code - A

C. 12

D. 11

41. The binary relation on the integers defined by $R = \{(a, b) : \ | b - a | \leq 1\}$ is

A. Reflexive only

B. Symmetric only

C. Reflexive and Symmetric

D. An equivalence relation

42. How many matrices of the form

$$\begin{pmatrix} x & \frac{2}{3} & \frac{2}{3} \\ \frac{2}{3} & \frac{1}{3} & y \\ z & s & t \end{pmatrix}$$

are orthogonal, where x, y, z, s and t are real numbers.

A. 1

B. 2

C. 0

D. infinity

43. Let A be the set of all complex numbers that lie on the circle whose radius is 2 and centre lies at the origin. Then

$$B = \{1 + 5z \mid z \in A\}$$

describes

A. a circle of radius 5 centred at $(-1, 0)$

B. a straight line

C. a circle of radius $\sqrt{5}$ with centre at $(-1, 0)$.

D. a circle of radius 10 centred at $(-1, 0)$

44. Let $P(x) = ax^2 + bx + c$ and $Q(x) = -ax^2 + bx + c$, where $ac \neq 0$. Then for the polynomial $P(x)Q(x)$

A. All its roots are real

B. None of its roots are real

C. At least two of its roots are real

D. Exactly two of its roots are real

45. A point P on the line $3x + 5y = 15$ is equidistant from the coordinate axes. Then P can lie in

A. Quadrant I only

B. Quadrant I or Quadrant III only

C. Quadrant I or Quadrant II only

D. any Quadrant

46. A circle and a square have the same perimeter. Then

A. their areas are equal

B. the area of the circle is larger

C. the area of the square is larger

D. the area of the circle is π times the area of the square

47. Consider a set of real numbers $T = \{t_1, t_2, \ldots, \}$ defined as

$$t_j = \left(\frac{-1 + \sqrt{-3}}{2}\right)^j + \left(\frac{-1 - \sqrt{-3}}{2}\right)^j$$

. This set is

A. an unbounded infinite set

B. an infinite bounded set

C. a finite set with $| T | > 319$

D. a finite set with $| T | < 10$

Y-8

Booklet code - A

48. The value of

$$\frac{\cos 37^\circ + \sin 37^\circ}{\cos 37^\circ - \sin 37^\circ}$$

is

A. $\tan^2 74^\circ$

B. $\dfrac{\sec 37^\circ}{\csc 37^\circ}$

C. $\cot 8^\circ$

D. $\tan 16^\circ$

49. All the coefficients of the equation $ax^2 + bx + c = 0$ are determined by throwing a six-sided un-biased dice. The probability that the equation has real roots is

A. 57/216

B. 27/216

C. 53/216

D. 43/216

50. If $(123)_5 = (x3)_y$, then the number of possible pairs (x, y) is

A. 2

B. 4

C. 3

D. 1

51. Suppose 4 vertical lines are drawn on a rectangular sheet of paper. We name the lines $\overline{A_1B_1}, \overline{A_2B_2}, \overline{A_3B_3}$ and $\overline{A_4B_4}$ respectively. Suppose two players A and B join two disjoint pairs of end points within A_1 to A_4 and B_1 to B_4 respectively without seeing how the other is marking.

What is the probability that the figure thus formed has disconnected loops?

A. 1/3

B. 2/3

C. 3/6

D. 1/6

52. In a village having 5000 people, 100 people suffer from the disease Hepatitis B. It is known that the accuracy of the medical test for Hepatitis B is 90%. Suppose the medical test result comes out to be positive for Anil who belongs to the village, then what is the probability that Anil is actually having the disease.

A. 0.02

B. 0.16

C. 0.18

D. 0.3

53. Let A be an $n \times n$-skew symmetric matrix with $a_{11}, a_{22}, \ldots a_{nn}$ as diagonal entries. Then which of the following is correct?

A. $a_{11}a_{22}\cdots a_{nn} = a_{11}+a_{22}+\cdots+a_{nn}$

B. $a_{11}a_{22}\cdots a_{nn} = (a_{11} + a_{22} + \cdots + a_{nn})^2$

C. $a_{11} + a_{22} + \cdots + a_{nn} = (a_{11} + a_{22} + \cdots + a_{nn})^3$

D. All of the above

54. Find the statement that is NOT true about the graph of the equation $r = a\sin 2\theta$, where $a > 0$.

A. The graph is symmetric about both x- and y- axes

B. The graph of this equation is like a flower with four petals

C. Maximum value is obtained at $\theta = (2n+1)\pi/2, n \geq 0$

Y-8

Booklet code- A

D. The maximum value is a

55. If $x+y+z=0$ and $x^3+y^3+z^3-kxyz=0$, then only one of the following is true. Which one is it?

A. $k=3$ whatever be x, y and z.

B. $k=0$ whatever be x, y and z.

C. $k=+1$ or -1 or 0

D. If none of x, y, z is zero, then $k=3$.

56. The value of the power series

$$1-x^2+\frac{x^4}{2}-\ldots+(-1)^n\frac{x^{2n}}{n}$$

at $x=3$ is closest to

A. $\cos 3$ (in radians)

B. $\log(1+3^2)$

C. $\frac{1}{e^9}$

D. $\sec 9$ (in radians)

57.

$$\int_{-2}^{2} \text{maximum } \{x^2, |\, x \,|\}dx =$$

A. 17/3

B. 14/3

C. 1

D. 16/3

58. The distance between two binary strings of equal length is defined as the number of positions where the bits differ. The distance of a set of binary strings is the minimum distance of all pairs of binary strings in that set. Then, what is the distance of the following set?

{00011000, 11000111, 01010010, 11111111}

A. 5

B. 4

C. 2

D. 3

59. Consider the system of equations

$$\begin{aligned} 8x+7y+z &= 11 \\ x+6y+7z &= 27 \\ 13x-4y-19z &= -20 \end{aligned}$$

How many solutions does this system have?

A. Single

B. Finite

C. Zero

D. Infinite

60. Determine which sum of min-terms corresponding to the following boolean function:

x	y	z	$f(x,y,z)$
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

A. $z+y+x$

B. $xyz'+xy'z+x'yz$

C. $x'y'z+x'yz'+xy'z'$

D. $x'y'z'+xyz'+xy'z$

61. A decimal number N has 30 digits. Approximately, how many digits would the binary representation of N have?

Y-8

Booklet code - A

A. 30

B. 60

C. 90

D. 120

62. Let E be a shifting operation applied to a function f, such that $E(f)(x) = f(x + h)$ for some h in $\mathbb{R}$. Then, for non-zero real numbers α and β,

A. $E(\alpha f + \beta g) = \alpha E(f) + \beta E(g)$

B. $E(\alpha f + \beta g) = (\alpha + \beta)E(f + g)$

C. $E(\alpha f + \beta g) = \alpha\beta E(f + g)$

D. None of the above

63. When a parabola represented by the equation $y - 2x^2 = 8x + 5$ is translated 3 units to the left and 2 units up, the new parabola has its vertex at

A. $(-5, -1)$

B. $(-5, -5)$

C. $(-1, -3)$

D. $(-2, -3)$

64. Out of 300 candidates interviewed in a company, 150 have a two-wheeler, 100 have a credit card and 150 possess a mobile phone. Further, 60 of them were found to have both a two-wheeler and a credit card, 50 had both a credit card and a mobile phone and 50 had both a two-wheeler and a mobile phone and 20 had all the three. How many candidates had at least one of those?

A. 40

B. 260

C. 280

D. 140

65. A man can hit a target once in 5 shots. If he fires 5 shots in succession, what is the probability that he will hit his target?

A. 1

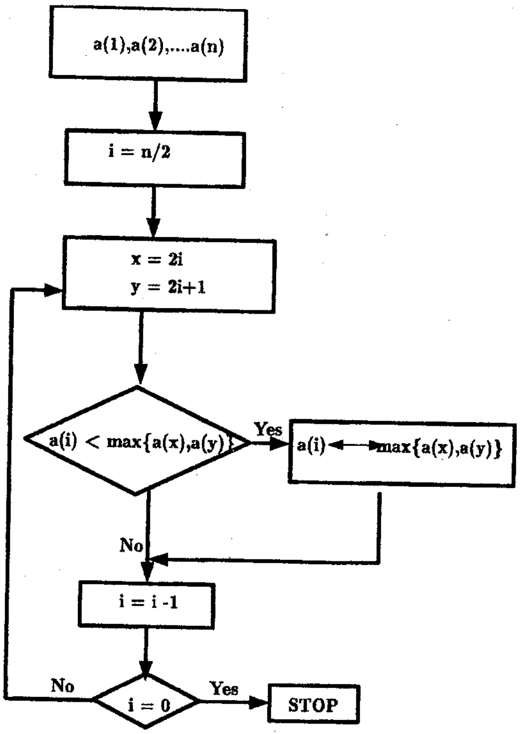
B. $\frac{1}{5^5}$

C. $\frac{1024}{3125}$

D. $\frac{2101}{3125}$

The Questions 66–69 are based on the flow-chart given below.

Assume that the input is $(11, 12, 6, 3, 2, 7, 8)$ for all the questions. The symbol $\leftrightarrow$ stands for interchange of values, the division operation is integer division



66. What is the output sequence?

Y-8

Booklet code - A

A. (2, 3, 6, 7, 8, 11, 12)

B. (12, 11, 8, 3, 2, 7, 6)

C. (12, 11, 8, 7, 6, 3, 2)

D. None of the above

67. How many times does the interchange of $a(i)$ with $max\{a(x), a(y)\}$ occur?

A. 0

B. 1

C. 2

D. 3

68. What will be the output if we change the comparison statement from $a(i) < max\{a(x), a(y)\}$ to $a(i) > max\{a(x), a(y)\}$?

A. (6, 3, 11, 12, 2, 7, 8)

B. (11, 3, 6, 12, 2, 7, 8)

C. (2, 3, 6, 7, 8, 11, 12)

D. (12, 11, 8, 7, 6, 3, 2)

69. What will be the output if 'max' is replaced by 'min' in the flow-chart?

A. (11, 2, 6, 3, 12, 7, 8)

B. (11, 12, 7, 3, 2, 6, 8)

C. (2, 3, 6, 7, 8, 11, 12)

D. (12, 11, 8, 7, 6, 3, 2)

70. Angle made by any tangent of the curve $y = x^5 + 8x + 1$ with x- axis is

A. always acute

B. always obtuse

C. can be either, depending on x

D. None of the above

71.

$$\lim_{n\to\infty} \prod_{i=2}^{n} \left(1 - \frac{1}{i^2}\right) =$$

A. 1

B. 1/2

C. 3/4

D. 0

72. Let $f : [0,1] \to [0,1]$ be a continuous function. The equation $f(x) = x$

A. may not have any solution

B. must have exactly one solution

C. must have at least one solution

D. must have at least two solutions

73. The rational function $f(x) = \dfrac{ax+2}{x+b}$ has the inverse function $f^{-1}(x) = \dfrac{ax+2}{x+b}$. Then find $a + b$.

A. 0

B. -2

C. -1/2

D. 1/2

74. Suppose a random variable X follows a binomial distribution with parameters $n = 6$ and p. If

$$9Pr(X = 4) = Pr(X = 2),$$

then $p =$

A. 2/3

B. 1/4

C. 1/3

D. 3/4

Y-8

Booklet code - A

75. In solving a system of linear equations $Ax = b$ by LU decomposition; the L and U matrices of the matrix

$$\mathbf{A} = \begin{bmatrix} 1 & -1 & 1 \\ 0 & -1 & -1 \\ 1 & 2 & 0 \end{bmatrix}$$

A.

$$\mathbf{L} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 1 & 3 & -4 \end{bmatrix}, \mathbf{U} = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

B.

$$\mathbf{L} = \begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & -1 \\ 1 & 0 & 2 \end{bmatrix}, \mathbf{U} = \begin{bmatrix} 1 & -1 & -1 \\ 0 & 1 & 1 \\ 0 & 0 & 2 \end{bmatrix}$$

C.

$$\mathbf{L} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 1 & 3 & -2 \end{bmatrix}, \mathbf{U} = \begin{bmatrix} 1 & -1 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$$

D. None of the above

Y-8