CLASS TEST

S.No.: 01JPCS_EM_16042026

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ENGINEERING MATHEMATICS

COMPUTER SCIENCE & IT

Date of Test : 16/04/2026

ANSWER KEY

1.	(c)	7.	(b)	13.	(c)	19.	(d)	25.	(b)
2.	(b)	8.	(c)	14.	(c)	20.	(b)	26.	(c)
3.	(a)	9.	(b)	15.	(c)	21.	(c)	27.	(b)
4.	(b)	10.	(d)	16.	(d)	22.	(b)	28.	(b)
5.	(c)	11.	(c)	17.	(b)	23.	(c)	29.	(b)
6.	(c)	12.	(b)	18.	(a)	24.	(b)	30.	(d)

DETAILED EXPLANATIONS

1. (c)

Here given $\mu = 2$ (on average 2 rupees per day)

$x = 3$

So, applying Poisson distribution,

$$P(x, \mu) = \frac{e^{-\mu}\mu^x}{x!}$$

$$P(3, 2) = \frac{(e)^{-2}\cdot(2)^3}{3!} = \frac{0.1353\times 8}{6} = 0.18$$

Thus the probability of earning 3 rupees is 0.18

2. (b)

Here rank(A) = rank(AB) < Number of variables

So, there will be many solutions possible.

3. (a)

$$A^2 + B^2 = AA + BB$$

$$\downarrow$$

$$= \underline{ABA} + \underline{BAB} \qquad \text{(Using values of } A \text{ and } B\text{)}$$

$$= BA + AB$$

$$= \underbrace{A + B}$$

4. (b)

Given, $$f(x) = \left(\frac{2x^2 - 5x + 2}{5x^2 - 15x + 10}\right) \quad \left[\frac{0}{0} \text{ form}\right]$$

Using L Hospital's rule

$$\lim_{x\to 2}\left(\frac{4x-5}{10x-15}\right)$$

$$= \frac{8-5}{20-15} = \frac{3}{5}$$

5. (c)

Only first two tosses are heads

So, P(H, H, T, T, T)

And each toss is independent.

So, required probability

$$= P(H) \times P(H) \times (P(T))^3$$

$$= \left(\frac{1}{2}\right)^2\left(\frac{1}{2}\right)^3 = \left(\frac{1}{2}\right)^5$$

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6. (c)

Given, $a = 0.6$

X	0	1
$P(X)$	0.6	0.4

$$\text{Required value} = V(X) = E(X^2) - [E(X)]^2$$

$$E(X) = \sum_i X_i P_i = 0 \times 0.6 + 1 \times 0.4 = 0.4$$

$$E(X^2) = \sum_i X_i^2 P_i = 0^2 \times 0.6 + 1^2 \times 0.4 = 0.4$$

$$\therefore \quad V(X) = E(X^2) - [E(X)]^2$$
$$= 0.4 - 0.16 = 0.24$$

7. (b)

$$P(A) = \frac{1}{4}, \quad P(B) = \frac{1}{6}$$

Both events are independent,

So, $$P(A \cap B) = P(A) \cdot P(B) = \frac{1}{4} \times \frac{1}{6} = \frac{1}{24}$$

$$P\left(\frac{A}{B}\right) = \frac{P(A \cap B)}{P(B)} = \frac{\frac{1}{24}}{\frac{1}{6}} = \frac{6}{24} = \frac{1}{4}$$

$$P\left(\frac{B}{A}\right) = \frac{P(A \cap B)}{P(A)} = \frac{\frac{1}{24}}{\frac{1}{6}} = \frac{4}{24} = \frac{1}{6}$$

8. (c)

Probability density of a function is given by

$$f(x) = \frac{e^{-\lambda}\lambda^x}{x!} \quad \ldots\text{(i)}$$

Given, $$f(x) = \frac{e^{-4}4^x}{x!} \quad \ldots\text{(ii)}$$

On comparing equation (i) and (ii) we get $\lambda = 4$.

9. (b)

It is a form of $\frac{0}{0}$ so, apply L'Hospital rule

$$\lim_{x \to 0} \frac{e^x - (1+x)}{3x^2}$$

$$\lim_{x \to 0} \frac{e^x - 1}{6x} \quad \left[\because \frac{0}{0}\right]$$

$$= \frac{e^x}{6} = \frac{1}{6}$$

10. (d)

$$\text{Standard deviation} = \sqrt{\text{variance}} = \sqrt{\frac{(\beta-\alpha)^2}{12}}$$

here $\beta = 3, \alpha = 1 = \sqrt{\frac{2^2}{12}} = \frac{1}{\sqrt{3}}$

11. (c)

The determinant of given matrix is 0.

$$D = \begin{vmatrix} 265 & 240 & 219 \\ 240 & 225 & 198 \\ 219 & 198 & 181 \end{vmatrix} \quad C_1 \leftarrow C_1 - C_2,\ C_3 \rightarrow C_3 - 10C_2$$

$C_1 \rightarrow C_1 - C_3,\ C_2 \rightarrow C_2 - C_3$
$$D = \begin{vmatrix} 4 & 21 & 9 \\ -12 & 27 & -72 \\ 4 & 17 & 11 \end{vmatrix}$$

$$D = \begin{vmatrix} 44 & 21 & 219 \\ 42 & 27 & 198 \\ 38 & 17 & 181 \end{vmatrix} \quad R_1 \rightarrow R_1 - R_3,\ R_2 \rightarrow R_2 + 3R_3$$

$$D = \begin{vmatrix} 0 & 4 & -2 \\ 0 & 78 & -39 \\ 4 & 17 & 11 \end{vmatrix} \qquad D = \begin{vmatrix} 0 & 2 & -1 \\ 0 & 2 & -1 \\ \underbrace{4 \quad 17 \quad 11}_{0} \end{vmatrix}$$

$$D = 2 \times 39 \times 0 = 0$$

12. (b)

$$\begin{bmatrix} 1 & 1 & 0 & -2 \\ 2 & 0 & 2 & 2 \\ 4 & 1 & 3 & 1 \end{bmatrix}$$

$R_2 \leftarrow R_2 - 2R_1, R_3 \leftarrow R_3 - 4R_1$

$$\begin{bmatrix} 1 & 1 & 0 & -2 \\ 0 & -2 & 2 & 6 \\ 0 & -3 & 3 & 9 \end{bmatrix}$$

$R_3 \leftarrow R_3 - \frac{3}{2}R_2$

$$\begin{bmatrix} 1 & 1 & 0 & -2 \\ 0 & -2 & 2 & 6 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Number of non-zero rows = 2

So, Rank of A = 2

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13. (c)

Take a 3 × 3 matrix and find λ.

$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & 2 & \lambda \\ 5 & 7 & \lambda^2 \end{vmatrix} = 0 \qquad [\because \text{ Rank of } X = 2]$$

$$(2\lambda^2 - 7\lambda) - 1(\lambda^2 - 5\lambda) + (7 - 10) = 0$$

$$2\lambda^2 - 7\lambda - \lambda^2 + 5\lambda - 3 = 0$$

$$\lambda^2 - 2\lambda - 3 = 0$$

$$\lambda = -1, 3$$

14. (c)

Let, A = First drawn orange is good

B = Second drawn orange is good

C = Third drawn orange is good

The oranges are not replaced.

Thus, $P(A) = \frac{12}{15}, P(B) = \frac{11}{14}, P(C) = \frac{10}{13}$

The box is approved for sale, if all three oranges are good.

Thus, the probability of getting all the oranges good

$$= \frac{12}{15} \times \frac{11}{14} \times \frac{10}{13} = \frac{44}{91}$$

15. (c)

$$f(x) = \sin^4 x$$

Also, $f(-x) = \sin^4(-x) = \sin^4 x = f(x)$

So, $$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \sin^4 x \, dx = 2\int_0^{\frac{\pi}{2}} \sin^4 x \, dx = 2\int_0^{\frac{\pi}{2}} \left(\frac{1 - \cos 2x}{2}\right)^2 dx$$

$$= \frac{1}{2}\int_0^{\frac{\pi}{2}} (1 + \cos^2 2x - 2\cos 2x) dx$$

$$\Rightarrow \frac{1}{2}\int_0^{\frac{\pi}{2}} \left(1 - \cos 2x + \frac{1 + \cos 4x}{2}\right) dx$$

$$\Rightarrow \frac{1}{4}\int_0^{\frac{\pi}{2}} (3 - 4\cos 2x + \cos 4x) dx$$

$$\Rightarrow \frac{1}{4}\left[3x - \frac{4\sin 2x}{2} + \frac{\sin 4x}{4}\right]_0^{\frac{\pi}{2}}$$

On solving we get $\frac{3\pi}{8}$.

16. (d)

Given : $f(x) = 2x^3 - 15x^2 + 36x + 2$

$\therefore$ $f'(x) = 6x^2 - 30x + 36$

For f_{max}, $f'(x) = 0$

$$6x^2 - 30x + 36x = 0$$
$$6(x^2 - 5x + 6) = 0$$
$$6(x - 2)(x - 3) = 0$$
$$x = 2, x = 3$$
$$f''(x) = 6(2x - 5)$$
$$x = 2, x = 3$$
$$f''(x) = 6(2x - 5)$$

At $x = 2$, $f''(2) = 6(2x - 5) = -6 < 0$ i.e. local maxima

At $x = 3$, $f''(3) = 6(1) = 6 > 0$ i.e. local minima

Hence, maximum value $= \max\{f(1), f(2), f(5)\}$

$$f(1) = 2 - 15 + 36 + 2 = 25$$
$$f(2) = 2 \times 2^3 - 15 \times 4 + 72 + 2 = 16 - 60 + 72 + 2 = 30$$
$$f(5) = 2 \times 5^3 - 15 \times 5^2 + 36 \times 5 + 2 = 57$$

Hence, maximum value of the function in the interval [1, 5] = 57.

17. (b)

$$\lim_{x\to 1^-} f(x) = \lim_{x\to 1^-} (x-1) = 0$$
$$\lim_{x\to 1^+} f(x) = \lim_{x\to 1^+} (x^3-1) = 0$$

Also $f(1) = 0$

Thus $\lim_{x\to 1^-} f(x) = \lim_{x\to 1^+} f(x) = f(1)$

$\Rightarrow$ f is continuous at $x = 1$

And $Lf'(1) = 1, Rf'(1) = 3$

$$Lf'(1) \neq Rf'(1)$$

Functon Y not differentiable at $x = 1$

18. (a)

(*i*) $E(X + 2Y) = E(X) + 2E(Y) = 1 + 2 \times 2 = 5$

(*ii*) $\text{Cov}(X, Y) = E(XY) - E(X)\,E(Y)$

$\Rightarrow$ $E(XY) = \text{Cov}(XY) + E(X)\,E(Y) = 1 + 1 \times 2 = 3$

(*iii*) $\text{Var}[X - 2Y + 1] = \text{Var}(X - 2Y) = \text{Var}(X) + (-2)^2\,\text{Var}(Y) - 4\,\text{Cov}(X, Y)$

$$= 1 + 4 \times 2 - 4 = 5$$

$\therefore$ $p = 5, q = 3, r = 5$

$\therefore$ $pq + r = 5 \times 3 + 5 = 20$

19. (d)

Since $\int_{-\infty}^{\infty} f(x)\,dx = 1$

$\Rightarrow$ $a\int_{-\infty}^{\infty} e^{-2|x|}\,dx = 1$

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We have $a\int_{-\infty}^{\infty} e^{-2|x|}\,dx = 2a\int_{0}^{\infty} e^{-2x}dx$ (for an even function)

$$= 2a\left(\frac{1}{2}\right) = a = 1$$

Therefore, $a = 1$

$$\text{Mean} = E[X] = \int_{-\infty}^{\infty} xe^{-2|x|}\,dx = 0$$

Hence, $\text{Variance} = E[X^2] - \{E[X]\}^2 = \int_{-\infty}^{\infty} x^2 e^{-2|x|}\,dx = 2\int_{0}^{\infty} x^2 e^{-2x}\,dx$

$$= 2\left[-\frac{x^2e^{-2x}}{2} - \frac{xe^{-2x}}{2} - \frac{e^{-2x}}{4}\right]_0^{\infty} = \frac{1}{2}$$

20. (b)

If $\lambda_1, \lambda_2, \ldots\ldots \lambda_n$ are the eigen value of A then the eigen value of adj A are $\frac{|A|}{\lambda_1}, \frac{|A|}{\lambda_{2n}}, \ldots\ldots \frac{|A|}{\lambda}$; $|A| \neq 0$.

Thus eigen values of adj A are $\frac{-8}{2}, \frac{-8}{4}$ i.e. –4 and 2, so, $x = -4$, $y = -2$ then sum $x + y = -6$.

21. (c)

$$|Adj(A)| = |A|^{n-1} \quad \ldots\ldots(1)$$

Where n is order of A,

Now,

$$|A| = 1\begin{vmatrix}5 & 1\\4 & 3\end{vmatrix} - 0\begin{vmatrix}2 & 1\\4 & 3\end{vmatrix} + 1.\begin{vmatrix}2 & 1\\5 & 1\end{vmatrix}$$

$\Rightarrow$ $|A| = 11 - 3$

$\Rightarrow$ $|A| = 8$

Using (1),

$$|Adj(A)| = 8^{3-1} = 8^2 = 64$$

22. (b)

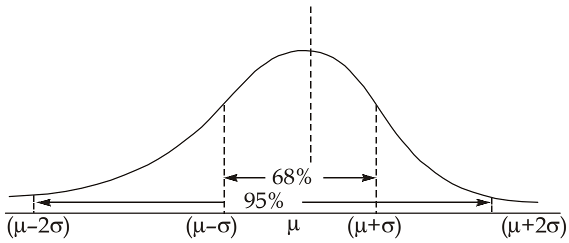
Given,

Mean, $\mu = 1200$

Variance, $\sigma^2 = 9 \times 10^4$

$\Rightarrow$ Standard deviation, $\sigma = \sqrt{9\times 10^4} = 300$

Using the property of the standard normal curve,



Probability of finding figures between

$$(\mu - 2\sigma) \text{ and } (\mu + 2\sigma) = 0.95$$

$$\mu - 2\sigma = 1200 - 2 \times 300 = 600$$

$$\mu + 2\sigma = 1200 + 2 \times 300 = 1800$$

i.e. $P\,(600 \le X \le 1800) = 0.95$

$\Rightarrow P(X \le 600) + P(X \ge 1800) = 1 - 0.95 = 0.05$

Since normal curve is symmetric w.r.t. mean value,

So, $P\,(X \le 600) = P\,(X \ge 1800)$

$\Rightarrow \quad 2P\,(X \ge 1800) = 0.05$

$\Rightarrow \quad P\,(X \ge 1800) = 0.025$

23. (c)

Given, $PQRS = I$

$\Rightarrow \quad PQRSS^{-1} = I \cdot S^{-1}$

$\Rightarrow \quad PQR = S^{-1}$

$\Rightarrow \quad PQRR^{-1} = S^{-1}\,R^{-1}$

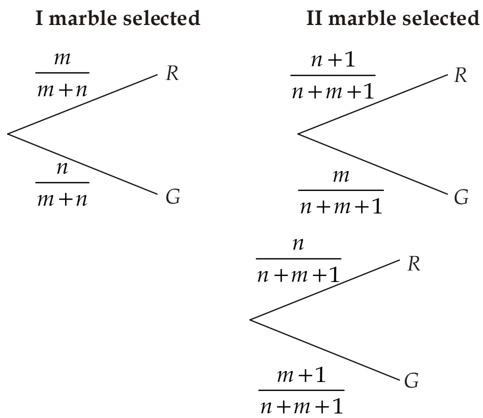
$\Rightarrow \quad PQ = S^{-1}\,R^{-1}$

$\Rightarrow \quad SPQ = S \cdot S^{-1}\,R^{-1} = R^{-1}$

$\Rightarrow \quad R^{-1} = SPQ$

24. (b)

The tree diagram for problem is



$$p(R) = \frac{m}{m+n} \times \frac{n \times 1}{n+m+1} + \frac{n}{m+n} \times \frac{n}{n+m+1}$$

$$= \frac{m(n+1) + n^2}{(m+n)(m+n+1)}$$

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25. (b)

Consider $n = 3$

Then $$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$$

and $$|A| = \begin{vmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{vmatrix} \quad \begin{matrix} R_3 \leftarrow 3R_1 - R_3 \\ R_2 \leftarrow 2R_1 - R_2 \end{matrix}$$

$$= \begin{vmatrix} 1 & 2 & 3 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{vmatrix}$$

This if $n = 3$ then Rank $(A) = 1$.

26. (c)

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

$$|A - \lambda I| = \begin{vmatrix} p-\lambda & 2 \\ -1 & 0-\lambda \end{vmatrix} = 0$$

$$(p - \lambda)(-\lambda) + 2 = 0$$

$$\lambda^2 - p\lambda + 2 = 0$$

Since this is characteristic equation

$$A^2 - pA + 2I = 0$$

Multiplying by A^{-1}, we get

$$A - pI + 2A^{-1} = 0$$

$$A + 3I + qA^{-1} = 0 \quad \text{(given)}$$

$$p = -3$$

$$q = 2$$

$$\frac{p}{q} = -1.5$$

27. (b)

$$P(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

$$P(x < 3) = P(x = 0) + P(x = 1) + P(x = 2)$$

$$= \frac{\lambda^0 e^{-\lambda}}{0!} + \frac{\lambda^1 e^{-\lambda}}{1!} + \frac{\lambda^2 e^{-\lambda}}{2!} = \frac{1}{e^\lambda} + \frac{\lambda}{e^\lambda} + \frac{\lambda^2}{2e^\lambda}$$

Given: $\lambda = 5.2$

$$= \frac{2 + 2\lambda + \lambda^2}{2e^\lambda}$$

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$$= \frac{2 + 2 \times 5.2 + (5.2)^2}{2 \times e^{5.2}} = 0.108$$

28. (b)

$$f'(1) = \lim \frac{f(1+h) - f(1)}{1+h-1}$$

$$= \lim_{h \to 0} \frac{1}{h}\left[\frac{1+h-1}{2(1+h)^2 - 7(1+h) + 5} - \left(-\frac{1}{3}\right)\right]$$

$$= \lim_{h \to 0} \frac{1}{h}\left[\frac{h}{2h^2 - 3h} + \frac{1}{3}\right] = \lim_{h \to 0} \frac{1}{h}\left[\frac{3h + 2h^2 - 3h}{3(2h^2 - 3h)}\right]$$

$$= \lim_{h \to 0} \frac{1}{h}\left[\frac{2h}{3(2h-3)}\right] = -\frac{2}{9} = -0.22 \qquad \text{[Here, LHD = RHD]}$$

29. (b)

$$f(x) = \begin{cases} 4x - 5, & \text{if } x \le 2 \\ x - \lambda, & \text{if } x > 2 \end{cases}$$

$$\therefore \quad \lim_{x \to 2^-} f(x) = \lim_{h \to 0} f(2-h)$$

$$= \lim_{h \to 0} [4(2-h) - 5]$$

$$= \lim_{h \to 0} [8 - 4h - 5]$$

$$= 3$$

$$\lim_{x \to 2^+} f(x) = \lim_{h \to 0} f(2+h)$$

$$= \lim_{h \to 0} [2 + h - \lambda]$$

$$= 2 - \lambda$$

Since limit exist, so,

$$\lim_{x \to 2^-} f(x) = \lim_{x \to 2^+} f(x)$$

$$2 - \lambda = 3$$

$$\lambda = -1$$

30. (d)

Every matrix satisfies it's own characteristic equation.

$|P - \lambda I|$ gives the characteristic equation.

$$= \begin{vmatrix} 2-\lambda & -2 & 3 \\ 1 & 1-\lambda & 1 \\ 1 & 3 & -1-\lambda \end{vmatrix} = \lambda^3 - 2\lambda^2 - 5\lambda + 6 = 0$$

$\therefore$ Option (d) is correct.

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