

MODEL QUESTION PAPER – 6

with Detailed Solutions

1. For a 2×2 matrix A sum of the eigen values is 0 and product of eigen values = -36. Then the eigen values are
- 1) ± 3 2) 4
3) ± 6 4) ± 7
2. A square matrix A and its transpose A^T have
- 1) same eigen values
2) distinct eigen values
3) cannot compare
4) none of these
3. If $A = \begin{bmatrix} 3 & 5 & 6 \\ 0 & 4 & 1 \\ 0 & 0 & 7 \end{bmatrix}$ then the eigen values of A^{-1} are
- 1) $\frac{1}{3}, \frac{1}{4}, \frac{1}{7}$ 2) $\frac{1}{3}, \frac{1}{5}, \frac{1}{6}$
3) $\frac{1}{3}, 1, \frac{1}{6}$ 4) $\frac{1}{6}, 1, \frac{1}{7}$
4. For a 3×3 matrix sum of eigen values = product of eigen values. Then the eigen values are
- 1) 3, 4, 5 2) 1, 2, 3
3) 5, 7, 8 4) 10, 11, 12
5. Find the sum of eigen values of $A = \begin{pmatrix} \cos \theta & -\sin \theta \\ -\sin \theta & -\cos \theta \end{pmatrix}$
- 1) 4 2) 2
3) 0 4) -2
6. Find the Eigen values of $A = \begin{bmatrix} 1000 \\ 2300 \\ 4560 \\ 6789 \end{bmatrix}$ are
- 1) 1, 2, 4, 6 2) 3, 4, 5, 7
3) 7, 6, 8, 9 4) 1, 3, 6, 9
7. Discuss the nature of the quadratic form $2x_1x_2 + 2x_2x_3 - 2x_1x_3$
- 1) Definite 2) Positive definite
3) Negative definite 4) Indefinite
8. If $A = f_{xx}(a, b)$, $B = f_{xy}(a, b)$ and $C = f_{yy}(a, b)$ then $f(x, y)$ has maximum at (a, b) if $f_x=0, f_y=0$ and
- 1) $AC-B^2>0, A<0$ 2) $AC-B^2>0, A>0$
3) $AC-B^2<0, A<0$ 4) $AC-B^2<0, A>0$
9. Solve: $x dx + y dy = a(x^2 + y^2) dy$
- 1) $e^{x^2+y^2} = x+c$
2) $\log(x+y) = x^2 + y^2 + c$
3) $\log(x^2+y^2) = 2ay+c$
4) none of these
10. Form partial differential equation from $z=f(x^2-y^2)$
- 1) $xq+yp=0$ 2) $xp+p=0$
3) $x+y+pq=0$ 4) $p+q=0$
11. If $p = 3x+2y-z$
 $q = x-2y+z$
 $r = x+2y-z$
then $\frac{\partial(p,q,r)}{\partial(x,y,z)} =$
- 1) 1 2) 2
3) 3 4) 0
12. The minimum value of $x^2+y^2+6x+12$ is
- 1) 1 2) 3
3) 2 4) 4
13. Find the directional derivative of a function $f(x, y, z) = x^2 + xy + z^2$ at the point A(1, -1, -1) in the direction of the line AB where B has coordinates (3, 2, 1)
- 1) $\frac{1}{17}$ 2) $\frac{3}{17}$
3) $\frac{1}{\sqrt{17}}$ 4) $\frac{36}{\sqrt{41}}$
14. Find a unit normal to the surface $x^2+3y^2+2z^2=6$ at $(2, 0, 1)$
- 1) $\frac{i-j}{\sqrt{2}}$ 2) $\frac{i+k}{\sqrt{3}}$
3) $\frac{i+k}{\sqrt{2}}$ 4) $\frac{i+j}{\sqrt{7}}$
15. $\nabla(\log r) =$
- 1) $\frac{\vec{r}}{r}$ 2) $\frac{\vec{r}}{r^2}$
3) $\frac{\vec{r}}{r^3}$ 4) $\frac{\vec{r}}{r^4}$
16. The vector $\vec{F} = yi + zj + xk$ is
- 1) solenoidal 2) irrotational
3) $\nabla^2 \vec{F} = 0$ 4) None of these

17. Find the bilinear transformation that maps the points $z_1 = \infty$, $z_2 = i$ and $z_3 = 0$ into the points $w_1 = 0$, $w_2 = i$ and $w_3 = \infty$

- 1) $w = -\frac{1}{z}$ 2) $w = \frac{1}{z}$
 3) $w = z + 2$ 4) $w = z^2$

18. The function $f(z) = |z|^2$ is

- 1) analytic 2) not analytic
 3) analytic at 0 4) none of these

19. For $f(z) = \frac{z^2 - \sin z^2}{z^6}$ $z=0$ is a

- 1) essential singular point
 2) pole
 3) removable singular point
 4) not a singular point

20. A river is 80 feet wide the depth d in feet at a distance x feet from one bank is given by the following table.

x	0	10	20	30	40	50	60	70	80
d	0	4	7	9	12	15	14	8	3

Find approximately the area of cross section of the river.

- 1) 710 sq. feet 2) 820 sq. feet
 3) 210 sq. feet 4) 535 sq. feet

21. Let $L f(t) = F(s)$ and $L f(at) = k F\left(\frac{s}{a}\right)$ then $k =$

- 1) a 2) $\frac{1}{a}$
 3) a^2 4) sa

22. Find $L^{-1}\left(\frac{1}{(s-1)(s+3)}\right)$

- 1) $\frac{e^t + e^{-3t}}{4}$ 2) $\frac{e^t + e^{3t}}{4}$
 3) $\frac{e^t e^{3t}}{4}$ 4) None of these

23. Find the z-transform of nC_k ($0 \leq k \leq n$)

- 1) $(1+z)^n$ 2) $(1+z^{-1})^n$
 3) $(1-z)^n$ 4) $(1-z^n)$

24. If the Fourier transform of $f(x)$ and $g(x)$ are $F(s)$ and $g(s)$ respectively, then $\int_{-\infty}^{\infty} F(S) \overline{G(S)} ds =$

- 1) $\int_{-\infty}^{\infty} f(x) \overline{g(x)} dx$ 2) $\int_{-\infty}^{\infty} f(x) + gx dx$
 3) 0 4) 1

25. An urn contains nine balls two of which are red, three blue and four black, three balls are

drawn from the urn at random. What is the probability that the three balls are of the same colour?

- 1) $\frac{2}{7}$ 2) $\frac{3}{7}$
 3) $\frac{5}{84}$ 4) $\frac{7}{85}$

26. A random variable X has the following probability function

Value of x	0	1	2	3	4	5	6	7	8
p(x)	a	3	5	7	9	11	13	15	17

Determine the value of 'a'

- 1) $\frac{1}{31}$ 2) $\frac{1}{61}$
 3) $\frac{1}{71}$ 4) $\frac{1}{81}$

27. For a normal variable which is normally distributed with mean 50, given that $P(X < 60) = \frac{4}{5}$ then $P(50 < X < 60) =$

- 1) $\frac{1}{2}$ 2) $\frac{3}{10}$
 3) $\frac{2}{5}$ 4) $\frac{2}{41}$

28. If X is a random variable having Poisson distribution such that $P(X=1) = 0.3$ and $P(X=2)=0.2$ then $\lambda =$

- 1) $\frac{28}{9}$ 2) $\frac{4}{3}$
 3) $\frac{3}{4}$ 4) $\frac{1}{3}$

29. A machine manufacturing screws is known to produce 5% defective. In a random sample of 15 screws. What is the probability that there are exactly three defectives

- 1) $15C_3 (0.5)^3 (9.5)^{12}$
 2) $15C_3 (0.05)^3 (0.95)^{12}$
 3) $15C_3 (0.005)^3 (0.095)^{12}$
 4) None of these

30. A large consignment of electric bulbs 10% are defective. A random sample of 20 is taken for inspection. Find the probability that all are good bulbs.

- 1) $(0.9)^{20}$ 2) $20(0.1)^2 (0.9)^2$
 3) $20(0.1)^3 (0.9)^3 +$ 4) $20(0.1)^{20} (0.9)^0$

ANSWERS

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

DETAILED SOLUTIONS

1. (3)

Let the eigen values be α and β

$$\text{Then sum} = \alpha + \beta = 0$$

$$\Rightarrow \alpha = -\beta$$

Product of eigen values

$$= -36$$

$$\Rightarrow \alpha\beta = -36$$

$$(-\beta)\beta = -36$$

$$\beta^2 = 36$$

$$\therefore \beta^2 = \pm 6$$

If $\beta = 6$ then $\alpha = -6$

If $\beta = -6$ then $\alpha = 6$

\therefore Eigen values are ± 6

2. (1)

A and A^T have same eigen values.

3. (1)

For a triangular matrix the eigen values are the diagonal elements

$$A = \begin{bmatrix} 3 & 5 & 6 \\ 0 & 4 & 1 \\ 0 & 0 & 7 \end{bmatrix} \text{ is}$$

a triangular matrix

\therefore Eigen values = 3, 4, 7

Therefore eigen values of A^{-1} are $\frac{1}{3}, \frac{1}{4}, \frac{1}{7}$

4. (2)

Consider 1, 2, 3

$$\text{Sum} = 1+2+3 = 6$$

$$\text{Product} = 1 \times 2 \times 3 = 6$$

\therefore Sum = product

\therefore Required eigen values are 1, 2, 3

5. (3)

Sum of eigen values of A = Trace of A

= Sum of main diagonal elements of A

$$= \cos \theta + (-\cos \theta)$$

$$= 0$$

6. (4)

For upper or lower triangular matrices the eigen values are nothing but the diagonal elements

$$A = \begin{bmatrix} 1000 \\ 2300 \\ 4560 \\ 6789 \end{bmatrix}$$

Clearly A is a triangular (lower) matrix.

\therefore Eigen values = 1, 3, 6, 9

7. (4)

The matrix of the quadratic form is

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

$$D_1 = |0| = 0$$

$$D_2 = \begin{vmatrix} 0 & 1 \\ 1 & 0 \end{vmatrix} = 0 - 1 = -1 < 0$$

$$D_3 = \begin{vmatrix} 0 & 1 & -1 \\ 1 & 0 & 1 \\ -1 & 1 & 0 \end{vmatrix}$$

$$= 0 - 1(1) - 1(1)$$

$$= -2 < 0$$

Hence $D_1 = 0$, $D_2 < 0$, $D_3 < 0$

Therefore the quadratic form is indefinite

8. (1)

If a function $f(x, y)$ is maximum at (a, b)

$$\text{If } \frac{\partial f}{\partial x} = 0, \frac{\partial f}{\partial y} = 0$$

$$\text{and } \frac{\partial^2 f}{\partial x^2} \cdot \frac{\partial^2 f}{\partial y^2} - \left(\frac{\partial^2 f}{\partial x \partial y} \right)^2 > 0 \text{ and } \frac{\partial^2 f}{\partial x^2} < 0$$

i.e., $f_{xx} \cdot f_{yy} - (f_{xy})^2 > 0$ and $f_{xx} < 0$

i.e., $f(x, y)$ is maximum at (a, b)

If $AC - B^2 > 0$ and $A < 0$

9. (3)

$$\frac{x dx + y dy}{x^2 + y^2} = ady$$

$$\Rightarrow \frac{\frac{1}{2} d(x^2 + y^2)}{x^2 + y^2} = ady$$

$$\Rightarrow \frac{d(x^2 + y^2)}{x^2 + y^2} = 2ady$$

$$\int \frac{d(x^2 + y^2)}{x^2 + y^2} = 2a \int dy$$

$$\Rightarrow \log(x^2 + y^2) = 2ay + c$$

10. (1)

$$z = f(x^2 - y^2)$$

$$p = \frac{\partial z}{\partial x} = f'(x^2 + y^2) 2x \quad \dots (1)$$

$$q = \frac{\partial z}{\partial y} = f'(x^2 + y^2)(-2y) \quad \dots (2)$$

$$(1) \div (2) \Rightarrow \frac{p}{q} = \frac{2x}{-2y}$$

$$\Rightarrow xq + yp = 0$$

11. (4)

$$\frac{\partial p}{\partial x} = 3; \frac{\partial p}{\partial y} = 2; \frac{\partial p}{\partial z} = -1$$

$$\frac{\partial p}{\partial x} = 1; \frac{\partial p}{\partial y} = -2; \frac{\partial q}{\partial z} = 1$$

$$\frac{\partial r}{\partial x} = 1; \frac{\partial r}{\partial y} = 2; \frac{\partial r}{\partial z} = -1$$

Now $\frac{\partial(p,q,r)}{\partial(x,y,z)}$

$$= \begin{vmatrix} \frac{\partial p}{\partial x} & \frac{\partial p}{\partial y} & \frac{\partial p}{\partial z} \\ \frac{\partial q}{\partial x} & \frac{\partial q}{\partial y} & \frac{\partial q}{\partial z} \\ \frac{\partial r}{\partial x} & \frac{\partial r}{\partial y} & \frac{\partial r}{\partial z} \end{vmatrix}$$

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

$$= 3(2-2)-2(-1-1)-1(2+2)$$

$$= +4-4$$

$$= 0$$

12. (2)

$$\text{Let } f = x^2 + y^2 + 6x + 12$$

$$\frac{\partial f}{\partial x} = 2x + 6$$

$$\frac{\partial^2 f}{\partial x^2} = 2$$

$$\frac{\partial f}{\partial y} = 2y$$

$$\frac{\partial^2 f}{\partial y^2} = 2$$

$$\frac{\partial^2 f}{\partial x \partial y} = 0$$

$$\text{For extremum, } \frac{\partial f}{\partial x} = 0, \frac{\partial f}{\partial y} = 0$$

$$2x+6=0 \Rightarrow x=-3$$

$$2y=0 \Rightarrow y=0$$

\therefore The point is (-3, 0)

$$A = \frac{\partial^2}{\partial x^2}(-3, 0) = 2$$

$$B = \frac{\partial^2}{\partial x \partial y}(-3, 0) = 0$$

$$C = \frac{\partial^2}{\partial y^2}(-3, 0) = 2$$

Now

$$AC-B^2 = 4-0>0$$

Also A = 2 > 0

 $\therefore (-3, 0)$ gives minimum

$$\text{minimum value} = (-3)^2 + (0)^2 + 6(-3) + 12 \\ = 9-18+12=3$$

13. (3)

$$\text{Let } \phi = x^2 + xy + z^2$$

$$\nabla \phi = \left(i \frac{\partial}{\partial x} + j \frac{\partial}{\partial y} + k \frac{\partial}{\partial z} \right) (x^2 + xy + z^2) \\ = i \frac{\partial(x^2 + xy + z^2)}{\partial x} + j \frac{\partial(x^2 + xy + z^2)}{\partial y} \\ + k \frac{\partial(x^2 + xy + z^2)}{\partial z}$$

$$= (2x+y)i + xj + 2zk$$

$$\nabla \phi (1, -1, -1)$$

$$= (2(1)+(-1))i + (1)j + 2(-1)k$$

$$= i + j - 2k$$

$$\overline{AB} = (3i+2j+k)-(i-j-k)$$

$$= (2i+3j+2k)$$

 \hat{e} = unit vector along

$$\overline{AB} = \frac{2i + 3j + 2k}{\sqrt{4 + 9 + 4}} = \frac{2i + 3j + 2k}{\sqrt{17}}$$

Directional derivative at the point (1, -1, -1) in the direction of the line \overline{AB}

$$= (i + j - 2k) \cdot \frac{(2i + 3j + 2k)}{\sqrt{17}}$$

$$= \frac{1}{\sqrt{17}} (2 + 3 - 4)$$

$$= \frac{1}{\sqrt{17}}$$

14. (3)

$$\text{Let } \phi = x^2 + 3y^2 + 2z^2 - 6$$

$$\nabla \phi = \left(i \frac{\partial}{\partial x} + j \frac{\partial}{\partial y} + k \frac{\partial}{\partial z} \right) (x^2 + 3y^2 + 2z^2 - 6)$$

$$= 2xi + 6yj + 4zk$$

Normal vector at $(2, 0, 1)$,

$$= \nabla \phi(2, 0, 1) = 4i + 4k$$

Unit normal vector at $(2, 0, 1)$

$$= \frac{4i + 4k}{\sqrt{16 + 16}} = \frac{1}{\sqrt{2}}(i + k)$$

15. (2)

Formula:

$$\nabla f(r) = f(r) \left(\frac{\vec{r}}{r} \right)$$

$$\therefore \nabla \log r = \frac{1}{r} \left(\frac{\vec{r}}{r} \right) = \frac{\vec{r}}{r^2}$$

16. (1)

$$\begin{aligned} \nabla \cdot \vec{F} &= \left(i \frac{\partial}{\partial x} + j \frac{\partial}{\partial y} + k \frac{\partial}{\partial z} \right) (yi + zj + xk) \\ &= \frac{\partial}{\partial x}(y) + \frac{\partial}{\partial y}(z) + \frac{\partial}{\partial z}(x) \end{aligned}$$

$$= 0 + 0 + 0$$

$$= 0$$

$\therefore F$ is solenoidal.

17. (1)

$$\text{Consider } W = -\frac{1}{z}$$

when $z_1 = \infty$ then

$$w_1 = \frac{-1}{\infty} = 0$$

when $z_2 = i$ then

$$w_2 = \frac{-1}{i} = i$$

when $z_3 = 0$

$$\text{then } w_3 = \frac{-1}{0} = \infty$$

$\therefore w = -\frac{1}{z}$ is the required bilinear form.

18. (2)

$$\text{Let } f(z) = u + iv = |z|^2 = x^2 + y^2$$

$$\Rightarrow u = x^2 + y^2; v = 0$$

$$\frac{\partial u}{\partial x} = 2x; \frac{\partial u}{\partial y} = 2y$$

$$\frac{\partial v}{\partial x} = 0; \frac{\partial v}{\partial y} = 0$$

$$\frac{\partial u}{\partial x} \neq \frac{\partial v}{\partial y}$$

\therefore So Cauchy Riemann equation is not satisfies

$\therefore f(z)$ is not analytic.

19. (3)

$$\begin{aligned} &\frac{z^2 - \sin z^2}{z^6} \\ &= \frac{1}{z^6} \left[z^2 \left[z^2 - \frac{(z^2)^3}{3!} + \frac{(z^2)^5}{5!} + \dots \right] \right] \\ &= \frac{1}{z^6} \left[\frac{z^6}{3!} - \frac{z^{10}}{5!} + \frac{z^{14}}{7!} \right] \\ &= \frac{1}{3!} - \frac{z^4}{5!} + \frac{z^8}{7!} \dots \end{aligned}$$

Now $\lim_{z \rightarrow 0} f(z)$

$$\begin{aligned} &= \lim_{z \rightarrow 0} \left(\frac{1}{3!} - \frac{z^4}{5!} + \frac{z^8}{7!} \dots \right) \\ &= \frac{1}{3!} = \frac{1}{6} \end{aligned}$$

The limit exists

Therefore $z=0$ is a removable singular point.

20. (1)

x	0	10	20	30	40	50	60	70	80
y (=d)	0	4	7	9	12	15	14	8	3
	y_0	y_1	y_2	y_3	y_4	y_5	y_6	y_7	y_8

By Simpson's rule

$$\begin{aligned} \text{Area of cross-section} &= \int_0^{80} y dx \\ &= \frac{h}{3} [(y_0 + y_8) + 2(y_2 + y_4 + y_6) + 4(y_1 + y_3 + y_5 + y_7)] \\ &= \frac{10}{3} [3 + 2(33) + 4(36)] \\ &= 710 \text{ sq. feet.} \end{aligned}$$

21. (1)

Formula:

If $L[f(t)] = F(s)$, then

$$L[f(at)] = \frac{1}{a} F\left(\frac{s}{a}\right) \therefore k = \frac{1}{a}$$

22. (1)

$$\begin{aligned} \frac{1}{(s-1)(s+3)} &= \frac{A}{s-1} + \frac{B}{s+3} \\ &= \frac{A}{(s+3) + B(s-1)} \end{aligned}$$

$$\Rightarrow 1 = A(s+3) + B(s-1)$$

$$\text{put } s=1 \Rightarrow 1 = 4A$$

$$A = \frac{1}{4}$$

$$\text{put } s=-3 \Rightarrow 1 = -4B$$

$$\begin{aligned} B &= -\frac{1}{4} \\ \therefore L^{-1}\left(\frac{1}{(s-1)(s+3)}\right) &= L^{-1}\left[\frac{\left(\frac{1}{4}\right)}{(s-1)} - \frac{\left(\frac{1}{4}\right)}{(s+3)}\right] \end{aligned}$$

23. (2)

$$\begin{aligned} Z(f(k)) &= \sum_{k=-\infty}^{\infty} \frac{f(k)}{z^k} \\ \therefore Z(-n C_k) &= \sum_{k=0}^n n C_k z^{-k} \\ &= 1 + {}^n C_1 z^{-1} + {}^n C_2 z^{-2} + {}^n C_3 z^{-3} + \dots + {}^n C_n z^{-n} \\ &= (1+z^{-1})^n \text{ by binomial theorem} \end{aligned}$$

24. (1)

By Parseval's identity for fourier transform

$$\int_{-\infty}^{\infty} F(s) \overline{G(s)} ds = \int_{-\infty}^{\infty} f(x) g(x) dx$$

25. (3)

Three balls will be of the same colour if either 3 blue balls or 3 black balls are drawn

$$\begin{aligned} &= P(3 \text{ blue balls or } 3 \text{ black balls}) \\ &= P(3 \text{ blue balls}) + P(3 \text{ black balls}) \end{aligned}$$

$$\begin{aligned} &= \frac{3C_3}{9C_3} + \frac{4C_3}{9C_3} \\ &= \frac{\binom{3 \times 2 \times 1}{1 \times 2 \times 3}}{\binom{9 \times 8 \times 7}{1 \times 2 \times 3}} + \frac{\binom{4 \times 3 \times 2}{1 \times 2 \times 3}}{\binom{9 \times 8 \times 7}{1 \times 2 \times 3}} \\ &= \frac{1}{84} + \frac{4}{84} = \frac{5}{84} \end{aligned}$$

26. (4)

Since $P(x)$ is a probability mas function

$$\Rightarrow \sum P(x) = 1$$

$$\Rightarrow a+3a+5a+7a+9a+11a+13a+15a+17a=1$$

$$\Rightarrow 81a=1$$

$$\therefore a = \frac{1}{81}$$

27. (2)

$$P(X < 60) = \frac{4}{5}$$

$$\begin{aligned} \int_{-\infty}^{60} f(x) dx &= \frac{4}{5} \\ \int_{-\infty}^{50} f(x) dx + \int_{50}^{60} f(x) dx &= \int_{-\infty}^{60} f(x) dx \\ \int_{50}^{60} f(x) dx &= \int_{-\infty}^{60} f(x) dx - \int_{-\infty}^{50} f(x) dx \\ &= \frac{4}{5} - 0.5 \\ &= \frac{4}{5} - \frac{1}{2} \\ &= \frac{8-5}{10} = \frac{3}{10} \end{aligned}$$

28. (2)

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

$$P(X=1) = e^{-\lambda} \frac{\lambda^1}{1!} = \lambda e^{-\lambda} = 0.3 \quad \dots (1)$$

$$P(X=2) = e^{-\lambda} \frac{\lambda^2}{2!} = 0.2$$

$$\Rightarrow \frac{e^{-\lambda} \lambda^2}{2} = 0.2 \quad \dots (2)$$

$$\frac{(2)}{(1)} \Rightarrow$$

$$\frac{e^{-\lambda} \lambda^2}{\lambda e^{-\lambda}} = \frac{0.2}{0.3}$$

$$\Rightarrow \frac{\lambda}{2} = \frac{2}{3}$$

$$\Rightarrow \lambda = \frac{4}{3}$$

29. (2)

$$P = 5\% = \frac{5}{100} = 0.05$$

$$q = 1 - P = 1 - 0.05$$

$$= 0.95$$

$$n = 15$$

By binomial distribution

$$P(X=x) = nC_x p^x q^{n-x}$$

Required probability

$$= P(\text{exactly three defectives})$$

$$= P(X=3)$$

$$= 15C_3 (0.05)^3 (0.95)^{12}$$

30. (1)

$$P = \frac{10}{100} = 0.1$$

$$q = 1-p = 0.9$$

$$n = 20$$

By binomial distribution

$$P(X=x) = nC_x p^x q^{n-x}$$

P (all good bulbs)

$$\begin{aligned} &= P(\text{none are defective}) \\ &= P(0) = 20C_0(0.1)^0(0.9)^{20} \\ &= (0.9)^{20} \end{aligned}$$

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