
MEET THE
4
FANTASTIC FOUR
CA FOUNDATION BATCH LAUNCH FOR JUNE 2024

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CODE : SS12

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Theoretical Probability Distributions

- Discrete Probability Distributions
  - Binomial Distribution
  - Poisson Distribution
- Continuous Probability Distributions
  - Normal Distribution

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NOTE

RANDOM VARIABLE	PROBABILITY FUNCTION
Discrete	Probability mass function
Continuous	Probability Density function

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BINOMIAL DISTRIBUTION

(bi - parametric
discrete probability distribution)

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BINOMIAL DISTRIBUTION

- One of the most important and frequently used discrete probability distribution is Binomial Distribution.
- It is derived from a particular type of random experiment known as Bernoulli process named after the famous mathematician

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CHARACTERISTICS OF BERNOULLI TRIALS

i. Each trial is associated with two mutually exclusive and exhaustive outcomes (one is 'success' and other is 'failure')

ii. The trials are independent.

iii. The probability of a success (p) and failure,(q = 1–p), remain unchanged throughout the process.

iv. The number of trials is a finite positive integer.

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BINOMIAL VARIABLE

- A discrete random variable X is defined to follow binomial distribution with parameters n and p,

  to be denoted by

  $$X \sim B(n, p),$$

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PROBABILITY MASS FUNCTION

$$f(x) = p(X = x) = {}^{n}c_{x}\, p^{x}\, q^{n-x} \quad \text{for } x = 0, 1, 2, \ldots, n$$

$$= 0, \text{ otherwise}$$

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MEAN

- The mean of the binomial distribution is given by

$$\mu = n\,p$$

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VARIANCE

- The variance of the binomial distribution is given by

$$\sigma^2 = n\,p\,q$$

✦ Variance of a binomial variable is always less than its mean.

✦ Variance of X attains its maximum value at $p = q = 0.5$ and this maximum value is $n/4$.

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MODE

$(n+1)p$

INTEGER

- $\mu_0 = (n+1)p$
- $\mu_0 = (n+1)p - 1$

Bi - Modal

NON - INTEGER

μ_0 = the largest integer contained in $(n+1)p$

Uni- Modal

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ADDITIVE PROPERTY

If X and Y are two independent variables such that

$X \sim B(n_1, p)$ and $Y \sim B(n_2, p)$

Then $(X+Y) \sim B(n_1 + n_2, p)$

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APPLICATION OF BINOMIAL DISTRIBUTION

- Binomial distribution is applicable when the trials are independent and each trial has just two outcomes success and failure.
- It is applied in coin tossing experiments, sampling inspection plan, genetic experiments and so on.

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Example: A coin is tossed 10 times. Assuming the coin to be unbiased, what is the probability of getting

(i) 4 heads?

(ii) at least 4 heads?

(iii) at most 3 heads?

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Example: If 15 dates are selected at random, what is the probability of getting two Sundays?

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Example: The incidence of occupational disease in an industry is such that the workmen have a 10% chance of suffering from it. What is the probability that out of 5 workmen, 3 or more will contract the disease?

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Example: Find the probability of a success for the binomial distribution satisfying the following relation 4 P (x = 4) = P (x = 2) and having the parameter n as six.

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Example: Find the binomial distribution for which mean and standard deviation are 6 and 2 respectively.

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Example: An experiment succeeds thrice as after it fails. If the experiment is repeated 5 times, what is the probability of having no success at all ?

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Example: What is the mode of the distribution for which mean and SD are 10 and $\sqrt{5}$ respectively.

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Example: If x and y are 2 independent binomial variables with parameters 6 and 1/2 and 4 and 1/2 respectively, what is P (x + y ≥ 1)?

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EXERCISE- Set (B)

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Que. 1 What is the standard deviation of the number of recoveries among 48 patients when the probability of recovering is 0.75?

(a) 36.

(b) 81.

(c) 9.

(d) 3.

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Que. 2 X is a binomial variable with n = 20. What is the mean of X if it is known that x is symmetric?

(a) 5.

(b) 10.

(c) 2.

(d) 8.

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Que. 3 If X ~ B (n, p), what would be the greatest value of the variance of x when n = 16?

(a) 2.

(b) 4.

(c) 8.

(d) $\sqrt{5}$

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Que. 4 If x is a binomial variate with parameter 15 and 1/3, what is the value of mode of the distribution?

(a) 5 and 6.

(b) 5.

(c) 5.50.

(d) 6.

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Que. 5 What is the number of trials of a binomial distribution having mean and SD as 3 and 1.5 respectively?

(a) 2.

(b) 4.

(c) 8.

(d) 12.

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Que. 6 What is the probability of getting 3 heads if 6 unbiased coins are tossed simultaneously?

(a) 0.50.

(b) 0.25.

(c) 0.3125.

(d) 0.6875.

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Que. 7 If the overall percentage of success in an exam is 60, what is the probability that out of a group of 4 students, at least one has passed?

(a) 0.6525.

(b) 0.9744.

(c) 0.8704.

(d) 0.0256.

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Que. 8 What is the probability of making 3 correct guesses in 5 True – False answer type questions?

(a) 0.3125.

(b) 0.5676.

(c) 0.6875.

(d) 0.4325

EXERCISE- Set (C)

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Que. 1 If it is known that the probability of a missile hitting a target is 1/8, what is the probability that out of 10 missiles fired, at least 2 will hit the target?

(a) 0.4258.

(b) 0.3968.

(c) 0.5238.

(d) 0.3611.

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Que. 2 X is a binomial variable such that 2 P(X = 2) = P(X = 3) and mean of X is known to be 10/3. What would be the probability that X assumes at most the value 2?

(a) 16/81.

(b) 17/81.

(c) 47/243.

(d) 46/243.

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Que. 3 Assuming that one-third of the population is tea drinkers and each of 1000 enumerators takes a sample of 8 individuals to find out whether they are tea drinkers or not, how many enumerators are expected to report that five or more people are tea drinkers?

(a) 100.

(b) 95.

(c) 88.

(d) 90.

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Que. 4 If a random variable X follows binomial distribution with mean as 5 and satisfying the condition 10 P (X = 0) = P (X = 1), what is the value of P (x ≥ 1/ x > 0)?

(a) 0.67.

(b) 0.56.

(c) 0.99.

(d) 0.82.

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Que. 5 Out of 128 families with 4 children each, how many are expected to have at least one boy and one girl?

(a) 100.

(b) 105.

(c) 108.

(d) 112.

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Que. 6 In 10 independent rollings of a biased die, the probability that an even number will appear 5 times is twice the probability that an even number will appear 4 times. What is the probability that an even number will appear twice when the die is rolled 8 times?

(a) 0.0304

(b) 0.1243

(c) 0.2315

(d) 0.1926

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Que. 7 If a binomial distribution is fitted to the following data:

x:	0	1	2	3	4
f:	16	25	32	17	10

then the sum of the expected frequencies for x = 2, 3 and 4 would be

(a) 58.

(b) 59.

(c) 60.

(d) 61.

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POISSON DISTRIBUTION

(UNI- parametric
discrete probability distribution)

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POISSON DISTRIBUTION

- Simon Denis Poisson of France introduced this distribution way back in the year 1837.
- Poisson distribution is applied when the total number of events is pretty large but the probability of occurrence is very small.

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POISSON VARIABLE

- A discrete random variable X that follows Poisson Distribution denoted as

$$X \sim P(m)$$

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PROBABILITY MASS FUNCTION

$$f(x) = P(X = x) = \frac{e^{-m} \cdot m^{x}}{x!} \text{ for } x = 0, 1, 2, \ldots \infty$$

where ,

e = 2.71828

m = n p

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MEAN

- The mean of Poisson distribution is given by

$$\mu = m$$

VARIANCE

- The variance of Poisson distribution is given by

$$\sigma^2 = m$$

STANDARD DEVIATION

$$\sqrt{m}$$

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MODE

m

INTEGER

- $\mu_0 = m$
- $\mu_0 = m - 1$

Bi - Modal

NON - INTEGER

μ_0 = the largest integer contained in m

Uni- Modal

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ADDITIVE PROPERTY

- If X and Y are two independent variables such that

$X \sim P(m_1)$ and $Y \sim P(m_2)$

$X + Y \sim P(m_1 + m_2)$

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APPLICATION OF POISSON DISTRIBUTION

a. The distribution of the no. of printing mistakes per page of a large book.

b. The distribution of the no. of road accidents on a busy road per minute.

c. The distribution of the no. of radio-active elements per minute in a fusion process.

d. The distribution of the no. of demands per minute for health centre and so on.

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Example: Find the mean and standard deviation of x where x is a Poisson variate satisfying the condition P (x = 2) = P (x = 3).

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Example: The probability that a random variable x following Poisson distribution would assume a positive value is $(1 - e^{-2.7})$. What is the mode of the distribution?

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Example: The standard deviation of a Poisson variate is 1.732. What is the probability that the variate lies between –2.3 to 3.68?

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Example: X is a Poisson variate satisfying the following relation:

$P(X = 2) = 9P(X = 4) + 90P(X = 6)$.

What is the standard deviation of X?

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Example: Between 9 and 10 AM, the average number of phone calls per minute coming into the switchboard of a company is 4. Find the probability that during one particular minute, there will be,

1. no phone calls

2. at most 3 phone calls (given e−4 = 0.018316)

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Example: If 2 percent of electric bulbs manufactured by a company are known to be defectives, what is the probability that a sample of 150 electric bulbs taken from the production process of that company would contain

1. exactly one defective bulb?

2. more than 2 defective bulbs?

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Example: The manufacturer of a certain electronic component is certain that two per cent of his product is defective. He sells the components in boxes of 120 and guarantees that not more than two per cent in any box will be defective. Find the probability that a box, selected at random, would fail to meet the guarantee? Given that $e^{-2.40} = 0.0907$.

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Example: A discrete random variable x follows Poisson distribution. Find the values of

(i) P (X = at least 1)

(ii) P (X ≤ 2/ X ≥ 1)

You are given E (x) = 2.20 and $e^{-2.20}$ = 0.1108.

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EXERCISE- Set (B)

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Write down the correct answers. Each question carries 2 marks.

Que. 9 If the standard deviation of a Poisson variate X is 2, what is P (1.5 < X < 2.9)?

(a) 0.231.

(b) 0.158.

(c) 0.15.

(d) 0.144.

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Write down the correct answers. Each question carries 2 marks.

Que. 10 If the mean of a Poisson variable X is 1, what is P (X = takes the value at least 1)?

(a) 0.456.

(b) 0.821.

(c) 0.632.

(d) 0.254.

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Write down the correct answers. Each question carries 2 marks.

Que. 11 If X ~ P (m) and its coefficient of variation is 50, what is the probability that X would assume only non-zero values?

(a) 0.018.

(b) 0.982.

(c) 0.989.

(d) 0.976.

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Write down the correct answers. Each question carries 2 marks.

Que. 12 If 1.5 percent of items produced by a manufacturing units are known to be defective, what is the probability that a sample of 200 items would contain no defective item?

(a) 0.05.

(b) 0.15.

(c) 0.20.

(d) 0.22.

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Write down the correct answers. Each question carries 2 marks.

Que. 13 For a Poisson variate X, P (X = 1) = P (X = 2). What is the mean of X?

(a) 1.00.

(b) 1.50.

(c) 2.00.

(d) 2.50.

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Write down the correct answers. Each question carries 2 marks.

Que. 14 If 1 percent of an airline's flights suffer a minor equipment failure in an aircraft, what is the probability that there will be exactly two such failures in the next 100 such flights?

(a) 0.50.

(b) 0.184.

(c) 0.265.

(d) 0.256.

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Write down the correct answers. Each question carries 2 marks.

Que. 15 If for a Poisson variable X, f(2) = 3 f(4), what is the variance of X?

(a) 2.

(b) 4.

(c) $\sqrt{2}$.

(d) 3.

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NORMAL / GAUSSIAN DISTRIBUTION

(BI - parametric CONTINUOUS probability distribution)

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NORMAL DISTRIBUTION

- The most important and universally accepted continuous probability distribution is known as normal distribution.
- Karl Gauss was instrumental for deriving normal distribution and as such normal distribution is also referred to as Gaussian Distribution.

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NORMAL VARIABLE

- A **continuous random variable x** is defined to follow normal distribution with parameters μ and σ^2, to be denoted by

$$X \sim N(\mu, \sigma^2)$$

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PROBABILITY DENSITY FUNCTION

$$P(x) = f(x) = \frac{1}{\sigma\sqrt{2\pi}} . e^{-(x-u)^2/2\sigma^2}$$

for $-\infty < x < \infty$.

- e = 2.71828
- X = random variable
- **μ = mean of normal random variable x**
- **σ = standard deviation of the given normal distribution**

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Example: For a random variable x, the probability density function is given by

$$f(x) = \frac{e^{-(x-4)^2}}{\sqrt{\pi}} \quad \text{for } -\infty < x < \infty .$$

Identify the distribution and find its mean and variance.

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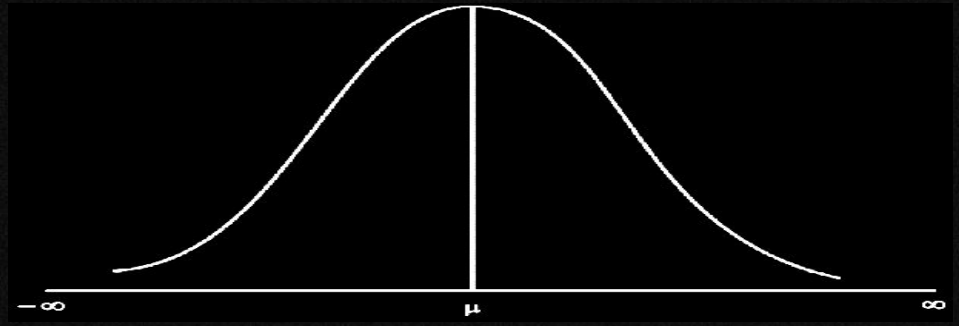
NORMAL CURVE

If we plot the probability function y = f (x), then the curve, known as probability curve, takes the following shape:



The area under this curve gives us the probability .

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NORMAL CURVE

- The normal curve is **bell shaped** and has one peak, which implies that the normal distribution has **one unique mode** .
- The line drawn through x = μ has divided the normal curve into two parts which are equal in all respect.

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NORMAL CURVE

- Such a curve is known as symmetrical curve and the corresponding distribution is known as symmetrical distribution .

- since the distribution is symmetrical

MEAN = MEDIAN = MODE = μ

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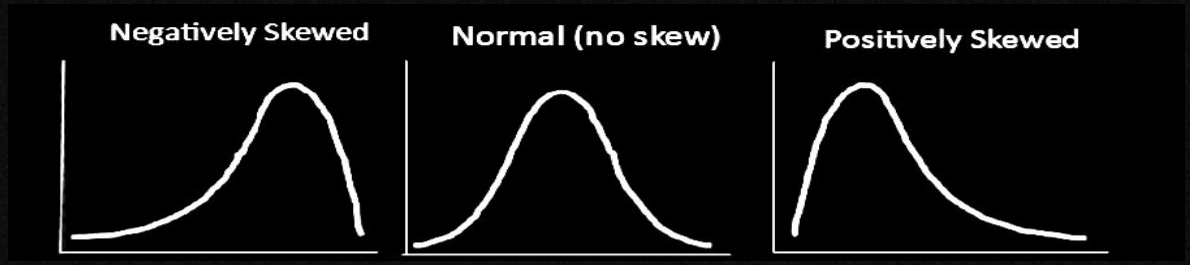
NORMAL CURVE

Thus, we find that the normal distribution is symmetrical about x = μ. As such, its skewness is zero i.e. the normal curve is neither inclined move towards the right (negatively skewed) nor towards the left (positively skewed)



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NORMAL CURVE

- The two tails of the normal curve extend indefinitely on both sides of the curve and both the left and right tails never touch the horizontal axis.
- The **total area of the normal curve** or for that any probability curve is taken to be **unity i.e. one.**

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NORMAL CURVE

- Since the vertical line drawn through $x = \mu$ divides the curve into two equal halves, it automatically follows that,

  The area between $-\infty$ to μ = the area between to μ to $\infty = 0.5$

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VARIANCE

- The variance of the Normal distribution is given in question

  σ^2 (parameter)

STANDARD DEVIATION

- The standard deviation of the normal distribution is given

  by σ

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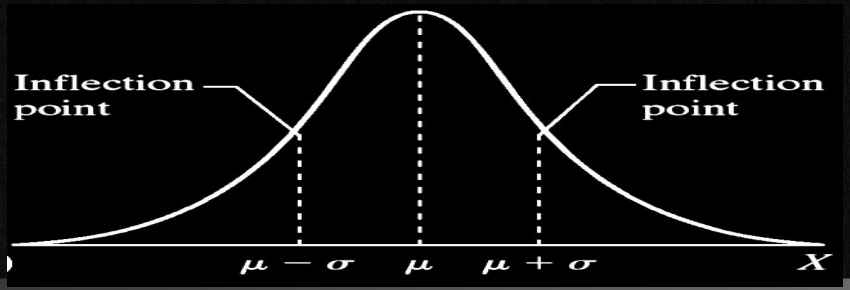
POINT OF INFLEXION

- The normal curve y = f (x) has **two points of inflexion** to be given by $x = \mu - \sigma$ and $x = \mu + \sigma$

i.e. at these two points, the normal curve changes its curvature from concave to convex and from convex to concave.



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Example: Find the points of inflexion of the normal curve

$$f(x) = \frac{1}{4\sqrt{2\pi}} . e^{-(x-10)^2/32}$$

for $-\infty < x < \infty$

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RELATIONSHIP BETWEEN SD ,MD , QD

- 4 SD = 5 MD = 6 QD

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MEAN DEVIATION

- Mean deviation of normal distribution is $\sigma\sqrt{\frac{2}{\pi}} \cong 0.8\sigma$

Mean deviation = 0.8 σ

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QUARTILE DEVIATION

- QD = 0.675 σ

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QUARTILES

- The first and third quartiles are given by

$$Q_1 = \mu - 0.675\,\sigma$$

and $$Q_3 = \mu + 0.675\,\sigma$$

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Example: If the two quartiles of a normal distribution are 47.30 and 52.70 respectively, what is the mode of the distribution? Also find the mean deviation about median of this distribution.

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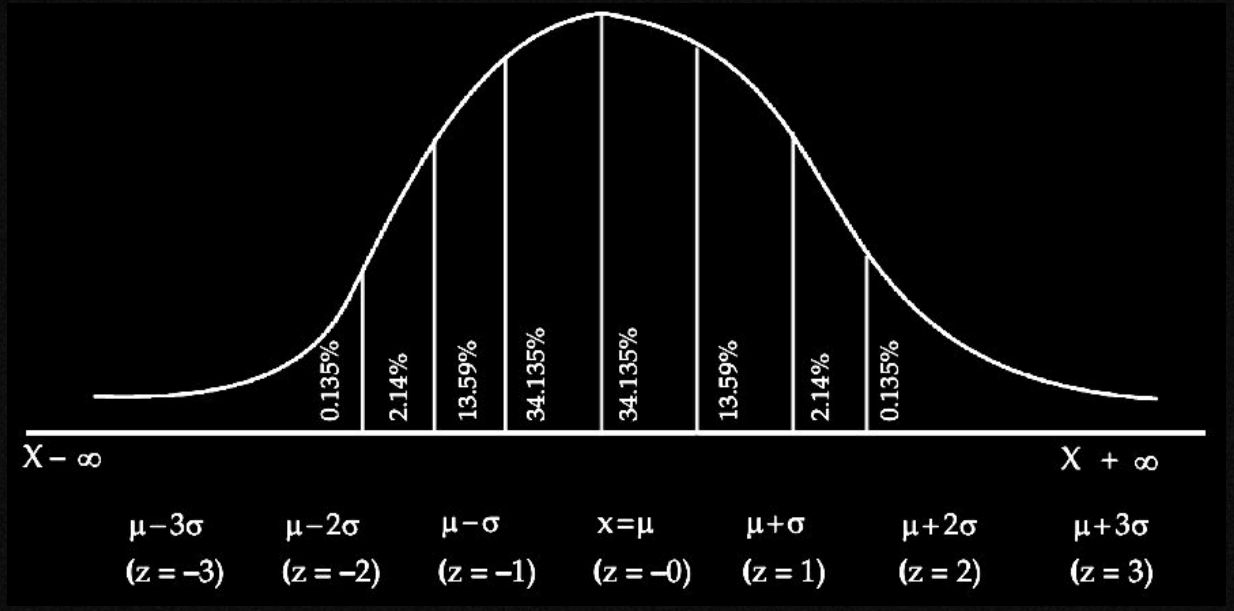
NORMAL CURVE



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NORMAL CURVE

$$P(\mu - \sigma < x < \mu + \sigma) = 0.6828$$

$$P(\mu - 2\sigma < x < \mu + 2\sigma) = 0.9546$$

$$P(\mu - 3\sigma < x < \mu + 3\sigma) = 0.9973$$

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NORMAL CURVE

- If x and y are independent normal variables with means and standard deviations as μ_1 and μ_2 and σ_1 and σ_2, respectively, then z = x + y also follows normal distribution with
- mean $(\mu_1 + \mu_2)$ and

$$SD = \sqrt{\sigma_1^2+\sigma_2^2} \text{ respectively.}$$

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Example: x and y are independent normal variables with mean 100 and 80 respectively and standard deviation as 4 and 3 respectively. What is the distribution of (x + y)?

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STANDARD NORMAL DISTRIBUTION

- If we take $\mu = 0$ and $\sigma = 1$

$$f(x) = \frac{1}{\sqrt{2\pi}} e^{-z^2/2} \qquad \text{for } -\infty < z < \infty$$

- The random variable z is known as standard normal variate (or variable) or standard normal deviate.
- It is given by $z = \frac{x - \mu}{\sigma}$

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STANDARD NORMAL DISTRIBUTION

- If $x \sim N(\mu, \sigma^2)$ then
- $z = (x - \mu)/\sigma \sim N(0, 1)$, z is known as standardised normal variate or normal deviate.

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IMPORTANT RESULTS of STANDARD NORMAL DISTRIBUTION

- Mean = Median = Mode= 0
- The standard normal distribution is symmetrical about z = 0
- Variance = 1
- Standard deviation = 1
- Point of Inflexion = -1 and 1
- Mean deviation = 0.8
- Quartile deviation = 0.675

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Example: X follows normal distribution with mean as 50 and variance as 100. What is P(x ≥ 60)? Given $\phi(1) = 0.8413$

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Example: If a random variable x follows normal distribution with mean as 120 and standard deviation as 40, what is the probability that P (x ≤ 150 / x > 120)?

Given that the area of the normal curve between z = 0 to z = 0.75 is 0.2734.

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Example: In a sample of 500 workers of a factory, the mean wage and SD of wages are found to be ₹ 500 and ₹ 48 respectively. Find the number of workers having wages:

(i) more than ₹ 600

(ii) less than ₹ 450

(iii) between ₹ 548 and ₹600.

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Example: The mean of a normal distribution is 500 and 16 percent of the values are greater than 600. What is the standard deviation of the distribution?

(Given that the area between z = 0 to z = 1 is 0.34)

EXERCISE- Set (B)

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Que. 16 What is the coefficient of variation of x, characterised by the following probability density function: $f(x) = \frac{1}{4\sqrt{2\pi}} e^{-(x-10)^2/32}$ for $-\infty < x < \infty$

(a) 50.

(b) 60.

(c) 40.

(d) 30.

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Que. 17 What is the first quartile of X having the following probability density function?

function: $f(x) = \frac{1}{\sqrt{72\pi}} e^{-(x-10)^2/72}$ for $-\infty < x < \infty$

(a) 4.

(b) 5.

(c) 5.95.

(d) 6.75.

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Que. 18 If the two quartiles of N (μ, σ^2) are 14.6 and 25.4 respectively, what is the standard deviation of the distribution?

(a) 9.

(b) 6.

(c) 10.

(d) 8.

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Que. 19 If the mean deviation of a normal variable is 16, what is its quartile deviation?

(a) 10.00.

(b) 13.50.

(c) 15.00.

(d) 12.05.

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Que. 20 If the points of inflexion of a normal curve are 40 and 60 respectively, then its mean deviation is

(a) 40.

(b) 45.

(c) 50.

(d) 60.

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Que. 21 If the quartile deviation of a normal curve is 4.05, then its mean deviation is

(a) 5.26.

(b) 6.24.

(c) 4.24.

(d) 4.80.

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Que. 22 If the Ist quartile and mean deviation about median of a normal distribution are 13.25 and 8 respectively, then the mode of the distribution is

(a) 20.

(b) 10.

(c) 15.

(d) 12.

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Que. 23 If the area of standard normal curve between z = 0 to z = 1 is 0.3413, then the value of $\phi(1)$ is

(a) 0.5000.

(b) 0.8413.

(c) –0.5000.

(d) 1.

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Que. 24 If X and Y are 2 independent normal variables with mean as 10 and 12 and SD as 3 and 4, then (X+Y) is normally distributed with

(a) mean = 22 and SD = 7.

(b) mean = 22 and SD = 25.

(c) mean = 22 and SD = 5.

(d) mean = 22 and SD = 49.

MATHS

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.M43	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2518	0.2549
0.7	0.2580	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	' 0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916-
2.4	' 0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4986	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999

EXERCISE- Set (A)

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Write down the correct answers. Each question carries 1 mark.

Que. 1 A theoretical probability distribution.

(a) does not exist.

(b) exists in theory.

(c) exists in real life.

(d) both (b) and (c).

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Write down the correct answers. Each question carries 1 mark.

Que. 2 Probability distribution may be

(a) discrete.

(b) continuous.

(c) infinite.

(d) (a) or (b).

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Write down the correct answers. Each question carries 1 mark.

Que. 3 An important discrete probability distribution is

(a) Poisson distribution.

(b) Normal distribution.

(c) Cauchy distribution.

(d) Log normal distribution.

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Write down the correct answers. Each question carries 1 mark.

Que. 4 An important continuous probability distribution

(a) Binomial distribution.

(b) Poisson distribution.

(c) Geometric distribution.

(d) Normal distribution.

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Write down the correct answers. Each question carries 1 mark.

Que. 5 Parameter is a characteristic of

(a) population.

(b) sample.

(c) probability distribution.

(d) both (a) and (b).

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Write down the correct answers. Each question carries 1 mark.

Que. 6 An example of a parameter is

(a) sample mean.

(b) population mean.

(c) binomial distribution.

(d) sample size.

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Write down the correct answers. Each question carries 1 mark.

Que. 7 A trial is an attempt to

(a) make something possible.

(b) make something impossible.

(c) prosecute an offender in a court of law.

(d) produce an outcome which is neither certain nor impossible.

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Write down the correct answers. Each question carries 1 mark.

Que. 8 The important characteristic(s) of Bernoulli trials

(a) each trial is associated with just two possible outcomes.

(b) trials are independent.

(c) trials are infinite.

(d) both (a) and (b).

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Write down the correct answers. Each question carries 1 mark.

Que. 9 The probability mass function of binomial distribution is given by

(a) $f(x) = p^x q^{n-x}$.

(b) $f(x) = {}^nc_x p^x q^{n-x}$.

(c) $f(x) = {}^nc_x q^x q^{n-x}$..

(d) $f(x) = {}^nc_x p^{n-x} q^x$.

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Write down the correct answers. Each question carries 1 mark.

Que. 10 If x is a binomial variable with parameters n and p, then x can assume

(a) any value between 0 and n.

(b) any value between 0 and n, both inclusive.

(c) any whole number between 0 and n, both inclusive.

(d) any number between 0 and infinity.

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Write down the correct answers. Each question carries 1 mark.

Que. 11 A binomial distribution is

(a) never symmetrical.

(b) never positively skewed.

(c) never negatively skewed.

(d) symmetrical when p = 0.5.

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Write down the correct answers. Each question carries 1 mark.

Que. 12 The mean of a binomial distribution with parameter n and p is

(a) n (1– p).

(b) np (1 – p).

(c) np.

(d) $\sqrt{np(1-p)}$.

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Write down the correct answers. Each question carries 1 mark.

Que. 13 The Variance of a binomial distribution with parameter n and p is

(a) $\frac{np^2(1-p)}{\sqrt{np(1-p)}}$.

(b)

(c) nq (1 – q).

(d) $np^2pp^2(1-p)p^2$

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Write down the correct answers. Each question carries 1 mark.

Que. 14 An example of a bi-parametric discrete probability distribution is

(a) binomial distribution.

(b) poisson distribution.

(c) normal distribution.

(d) both (a) and (b).

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Write down the correct answers. Each question carries 1 mark.

Que. 15 For a binomial distribution, mean and mode

(a) are never equal.

(b) are always equal.

(c) are equal when q = 0.50.

(d) do not always exist.

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Write down the correct answers. Each question carries 1 mark.

Que. 16 The mean of binomial distribution is

(a) always more than its variance.

(b) always equal to its variance.

(c) always less than its variance.

(d) always equal to its standard deviation.

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Write down the correct answers. Each question carries 1 mark.

Que. 17 For a binomial distribution, there may be

(a) one mode.

(b) two modes.

(c) multi modes

(d) (a) or (b).

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Write down the correct answers. Each question carries 1 mark.

Que. 18 The maximum value of the variance of a binomial distribution with parameters n and p is

(a) n/2.

(b) n/4.

(c) np (1 – p).

(d) 2n.

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Write down the correct answers. Each question carries 1 mark.

Que. 19 The method usually applied for fitting a binomial distribution is known as

(a) method of least square.

(b) method of moments.

(c) method of probability distribution.

(d) method of deviations.

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Write down the correct answers. Each question carries 1 mark.

Que. 20 Which one is not a condition of Poisson model?

(a) the probability of having success in a small time interval is constant.

(b) the probability of having success more than one in a small time interval is very small.

(c) the probability of having success in a small interval is independent of time and also of earlier success.

(d) the probability of having success in a small time interval (t, t + dt) is kt for a positive constant k.

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Write down the correct answers. Each question carries 1 mark.

Que. 21 Which one is uniparametric distribution?

(a) Binomial.

(b) Poisson.

(c) Normal.

(d) Hyper geometric.

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Write down the correct answers. Each question carries 1 mark.

Que. 22 For a Poisson distribution,

(a) mean and standard deviation are equal.

(b) mean and variance are equal.

(c) standard deviation and variance are equal.

(d) both (a) and (b).

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Write down the correct answers. Each question carries 1 mark.

Que. 23 Poisson distribution may be

(a) unimodal.

(b) bimodal.

(c) Multi-modal.

(d) (a) or (b).

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Write down the correct answers. Each question carries 1 mark.

Que. 24 Poisson distribution is

(a) always symmetric.

(b) always positively skewed.

(c) always negatively skewed.

(d) symmetric only when m = 2.

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Write down the correct answers. Each question carries 1 mark.

Que. 25 A binomial distribution with parameters n and p can be approximated by a Poisson distribution with parameter m = np is

(a) $n \to \infty$

(b) $p \to 0$.

(c) $n \to \infty$ and $p \to 0$.

(d) $n \to \infty$ and $p \to 0$ so that np remains finite..

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Write down the correct answers. Each question carries 1 mark.

Que. 26 For Poisson fitting to an observed frequency distribution,

(a) we equate the Poisson parameter to the mean of the frequency distribution.

(b) we equate the Poisson parameter to the median of the distribution.

(c) we equate the Poisson parameter to the mode of the distribution.

(d) none of these.

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Write down the correct answers. Each question carries 1 mark.

Que. 27 The most important continuous probability distribution is known as

(a) Binomial distribution.

(b) Normal distribution.

(c) Chi-square distribution.

(d) Sampling distribution.

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Write down the correct answers. Each question carries 1 mark.

Que. 28 The probability density function of a normal variable x is given by

(a) $f(x) = \frac{1}{\sigma\sqrt{2\pi}} . e^{-\frac{1}{2}(\frac{x-\mu}{\sigma})^2}$ for $-\infty < x < \infty$.

(b) $f(x) = \frac{1}{\sigma\sqrt{2\pi}} . e^{-\frac{-(x-\mu)^2}{2\sigma^2}}$ for $0 < x < \infty$.

(c) $f(x) = \frac{1}{\sqrt{2\pi\sigma}} . e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ for $-\infty < x < \infty$.

(d) none of these.

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Write down the correct answers. Each question carries 1 mark.

Que. 29 The total area of the normal curve is

(a) one.

(b) 50 per cent.

(c) 0.50.

(d) any value between 0 and 1.

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Write down the correct answers. Each question carries 1 mark.

Que. 30 The normal curve is

(a) Bell-shaped.

(b) U- shaped.

(c) J-shaped.

(d) Inverted J-shaped.

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Write down the correct answers. Each question carries 1 mark.

Que. 31 The normal curve is

(a) positively skewed.

(b) negatively skewed.

(c) symmetrical.

(d) all these.

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Write down the correct answers. Each question carries 1 mark.

Que. 32 Area of the normal curve

(a) between $-\infty$ to μ is 0.50.

(b) between ∞ to μ is 0.50.

(c) between $-\infty$ to ∞ is 0.50.

(d) both (a) and (b).

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Write down the correct answers. Each question carries 1 mark.

Que. 33 The cumulative distribution function of a random variable X is given by

(a) $F(x) = P(X \leq x)$.

(b) $F(X) = P(X \leq x)$.

(c) $F(x) = P(X \geq x)$.

(d) $F(x) = P(X = x)$.

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Write down the correct answers. Each question carries 1 mark.

Que. 34 The mean and mode of a normal distribution

(a) may be equal.

(b) may be different.

(c) are always equal.

(d) (a) or (b).

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Write down the correct answers. Each question carries 1 mark.

Que. 35 The mean deviation about median of a standard normal variate is

(a) 0.675 σ.

(b) 0.675.

(c) 0.80 σ.

(d) 0.80.

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Write down the correct answers. Each question carries 1 mark.

Que. 36 The quartile deviation of a normal distribution with mean 10 and SD 4 is

(a) 0.675.

(b) 67.50.

(c) 2.70.

(d) 3.20.

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Write down the correct answers. Each question carries 1 mark.

Que. 37 For a standard normal distribution, the points of inflexion are given by

(a) $\mu - \sigma$ and $\mu + \sigma$.

(b) $-\sigma$ and σ.

(c) –1 and 1.

(d) 0 and 1.

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Write down the correct answers. Each question carries 1 mark.

Que. 38 The symbol $\Phi(a)$ indicates the area of the standard normal curve between

(a) 0 to a.

(b) a to ∞.

(c) $-\infty$ to a.

(d) $-\infty$ to ∞.

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Write down the correct answers. Each question carries 1 mark.

Que. 39 The interval $(\mu - 3\sigma, \mu + 3\sigma)$ covers

(a) 95% area of a normal distribution.

(b) 96% area of a normal distribution.

(c) 99% area of a normal distribution.

(d) all but 0.27% area of a normal distribution.

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Write down the correct answers. Each question carries 1 mark.

Que. 40 Number of misprints per page of a thick book follows

(a) Normal distribution.

(b) Poisson distribution.

(c) Binomial distribution.

(d) Standard normal distribution.

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Write down the correct answers. Each question carries 1 mark.

Que. 41 The results of ODI matches between India and Pakistan follows

(a) Binomial distribution.

(b) Poisson distribution.

(c) Normal distribution.

(d) (b) or (c).

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Write down the correct answers. Each question carries 1 mark.

Que. 42 The wage of workers of a factory follow

(a) Binomial distribution.

(b) Poisson distribution.

(c) Normal distribution.

(d) Chi-square distribution.

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Write down the correct answers. Each question carries 1 mark.

Que. 43 If X and Y are two independent normal random variables, then the distribution of (X+Y) is

(a) normal.

(b) standard normal.

(c) T.

(d) chi-square.

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Poisson Model

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- Let us think of a random experiment under the following conditions:

I. The probability of finding success in a very small time interval (t, t + dt) is kt, where k (>0) is a constant.

II. The probability of having more than one success in this time interval is very low.

III. The probability of having success in this time interval is independent of t as well as earlier successes.