Probability distribution and Random Walk CSIR, JEST & TIFR

https://snboseplc.com/probability-distribution-and-random-walk-csir-jest-tifr/

CSIR Questions

Q.No:1 CSIR Dec-2014

Two independent random variables m and n, which can take the integer values $0, 1, 2, \cdots, \infty$, follow the Poisson distribution, with distinct mean values μ and ν respectively. Then

(1) the probability distribution of the random variable $l = m + n$ is a binomial distribution.

(2) the probability distribution of the random variable $r = m - n$ is also a Poisson distribution.

(3) the variance of the random variable $l = m + n$ is equal to $\mu + \nu$.

(4) the mean value of the random variable $r = m - n$ is equal to 0.

Q.No:2 CSIR Dec-2014

A random walker takes a step of unit length in the positive direction with probability 2/3 and a step of unit length in the negative direction with probability 1/3. The mean displacement of the walker after n steps is

(1) $n/3$

(2) $n/8$

(3) $2n/3$

(4) 0

Q.No:3 CSIR June-2015

Three real variables a, b and c are each randomly chosen from a uniform probability distribution in the interval $[0, 1]$. The probability that $a + b > 2c$ is

(1) $\frac{3}{4}$

(2) $\frac{2}{3}$

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

(4) $\frac{1}{4}$

Q.No:4 CSIR Dec-2015

Consider a random walker on a square lattice. At each step the walker moves to a nearest neighbour site with equal probability for each of the four sites. The walker starts at the origin and takes 3 steps. The probability that during this walk no site is visited more than once is

(1) 12/27

(2) 27/64

(3) 3/8

(4) 9/16

Q.No:5 CSIR Dec-2016

Consider a continuous time random walk. If a step has taken place at time $t = 0$, the probability that the next step takes place between t and $t + dt$ is given by $bt\,dt$, where b is a constant. What is the average time between successive steps?

(1) $\sqrt{\frac{2\pi}{b}}$

(2) $\sqrt{\frac{\pi}{b}}$

(3) $\frac{1}{2}\sqrt{\frac{\pi}{b}}$

(4) $\sqrt{\frac{\pi}{2b}}$

Q.No:6 CSIR Dec-2016

Consider a random walk on an infinite two-dimensional triangular lattice, a part of which is shown in the figure below.

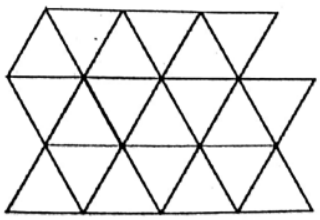


Figure 1: Triangular lattice for Q.No:6

If the probabilities of moving to any of the nearest neighbour sites are equal, what is the probability that the walker returns to the starting position at the end of exactly three steps?

(1) $\frac{1}{36}$

(2) $\frac{1}{216}$

(3) $\frac{1}{18}$

(4) $\frac{1}{12}$

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Q.No:7 CSIR June-2017

The random variable x $(-\infty < x < \infty)$ is distributed according to the normal distribution $P(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}}$. The probability density of the random variable $y = x^2$ is

(1) $\frac{1}{\sqrt{2\pi\sigma^2 y}} e^{-y/2\sigma^2}, \quad 0 \leq y < \infty$

(2) $\frac{1}{2\sqrt{2\pi\sigma^2 y}} e^{-y/2\sigma^2}, \quad 0 \leq y < \infty$

(3) $\frac{1}{\sqrt{2\sigma^2}} e^{-y/2\sigma^2}, \quad 0 \leq y < \infty$

(4) $\frac{1}{\sqrt{2\pi\sigma^2 y}} e^{-y/\sigma^2}, \quad 0 \leq y < \infty$

Q.No:8 CSIR June-2017

A random variable n obeys Poisson statistics. The probability of finding $n = 0$ is 10^{-6}. The expectation value of n is nearest to

(1) 14

(2) 10^6

(3) e

(4) 10^2

Q.No:9 CSIR Dec-2018

A particle hops on a one-dimensional lattice with lattice spacing a. The probability of the particle to hop to the neighbouring site to its right is p, while the corresponding probability to hop to the left is $q = 1-p$. The root-mean-squared deviation $\Delta x = \sqrt{\langle x^2 \rangle - \langle x \rangle^2}$ in displacement after N steps, is

(1) $a\sqrt{Npq}$

(2) $aN\sqrt{pq}$

(3) $2a\sqrt{Npq}$

(4) $a\sqrt{N}$

Q.No:10 CSIR June-2019

At each time step, a random walker in one-dimension either remains at the same point with probability $\frac{1}{4}$, or moves by a distance Δ to the right or left with probabilities 3/8 each. After N time steps, its root mean squared displacement is

(1) $\Delta\sqrt{N}$

(2) $\Delta\sqrt{\frac{9N}{16}}$

(3) $\Delta\sqrt{\frac{3N}{4}}$

(4) $\Delta\sqrt{\frac{3N}{8}}$

Q.No:11 CSIR Dec-2019

A box contains 5 white and 4 black balls. Two balls are picked together at random from the box. What is the probability that these two balls are of different colours?

(1) 1/2

(2) 5/18

(3) 1/3

(4) 5/9

Q.No:12 CSIR Dec-2019

A particle hops randomly from a site to its nearest neighbour in each step on a square lattice of unit lattice constant. The probability of hopping to the positive x-direction is 0.3, to the negative x-direction is 0.2, to the positive y-direction is 0.2 and to the negative y-direction is 0.3. If a particle starts from the origin, its mean positive after N steps is

(1) $\frac{1}{10}N(-\hat{i} + \hat{j})$

(2) $\frac{1}{10}N(\hat{i} - \hat{j})$

(3) $N(0.3\hat{i} - 0.2\hat{j})$

(4) $N(0.2\hat{i} - 0.3\hat{j})$

Q.No:13 Assam CSIR Dec-2019

There are n distinguishable balls which are to be put in n boxes, where each box can contain at most $(n-1)$ balls. The number of ways in which the balls can be distributed in the boxes is

(1) $n(n^{n-1} - 1)$

(2) $(n-1)^n$

(3) n^{n-1}

(4) $n! - n$

Q.No:14 Assam CSIR Dec-2019

A particle hops randomly from one site to a neighbouring site on a one-dimensional lattice. The probability of hopping to the left is p and that to the right is q. After exactly 4 hops the probability of finding the particle at the starting site is

(1) p^2q^2

(2) $2p^2q^2$

(3) $4p^2q^2$

(4) $6p^2q^2$

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Q.No:15 Assam CSIR Dec-2019

The photon flux in an argon laser is 2.5×10^5 $m^{-2}s^{-1}$. A photo detector is used to convert photons to electrons with a 10% conversion efficiency. Assuming Poisson statistics, the mean value of and the fluctuations in the number of photons that are detected per unit area in a time interval of 0.1 s are, respectively, nearest to

(1) 2500 and 50

(2) 2500 and 250

(3) 250 and 12

(4) 25000 and 158

Q.No:16 CSIR June-2020

A basket consists of an infinite number of red and black balls in the proportion $p : (1-p)$. Three balls are drawn at random without replacement. The probability of their being two red and one black is a maximum for

(a) $p = \frac{3}{4}$

(b) $p = \frac{3}{5}$

(c) $p = \frac{1}{2}$

(d) $p = \frac{2}{3}$

Q.No:17 CSIR Feb-2022

The position of a particle in one dimension changes in discrete steps. With each step it moves to the right, however, the length of the step is drawn from a uniform distribution from the interval $[\lambda - \frac{1}{2}\omega, \lambda + \frac{1}{2}\omega]$, where λ and ω are positive constants. If X denotes the distance from the starting point after N steps, the standard deviation $\sqrt{\langle x^2\rangle - \langle x\rangle^2}$ for large values of N is

(1) $\frac{\lambda}{2} \times \sqrt{N}$

(2) $\frac{\lambda}{2} \times \sqrt{\frac{N}{3}}$

(3) $\frac{\omega}{2} \times \sqrt{N}$

(4) $\frac{\omega}{2} \times \sqrt{\frac{N}{3}}$

Q.No:18 CSIR Feb-2022

A discrete random variable X takes a value from the set $\{-1, 1, 2\}$ with the corresponding probabilities $p(X) = 3/10, 2/10, 2/10$ and $3/10$, respectively. The probability distribution $q(Y) = (q(0), q(1), q(4))$ of the random variable $Y = X^2$ is

(1) $(\frac{1}{5}, \frac{3}{5}, \frac{1}{5})$

(2) $(\frac{1}{5}, \frac{1}{2}, \frac{3}{10})$

(3) $(\frac{2}{5}, \frac{2}{5}, \frac{1}{5})$

(4) $(\frac{3}{10}, \frac{3}{10}, \frac{2}{5})$

Q.No:19 CSIR Sep-2022

A walker takes steps, each of length L, randomly in the directions along east, west, north and south. After four steps its distance from the starting point is d. The probability that $d \leq 3L$ is

(1) 63/64

(2) 59/64

(3) 57/64

(4) 55/64

Q.No:20 CSIR Sep-2022

A bucket contains 6 red and 4 blue balls. A ball is taken out of the bucket at random and two balls of the same colour are put back. This step is repeated once more. The probability that the numbers of red and blue balls are equal at the end, is

(1) 4/11

(2) 2/11

(3) 1/4

(4) 3/4

Q.No:21 CSIR-June-2023

A random variable Y obeys a normal distribution

$$P(Y) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left[-\frac{(Y-\mu)^2}{2\sigma^2}\right]$$

The mean value of e^Y is

(1) $e^{\mu+\frac{\sigma^2}{2}}$

(2) $e^{\mu-\sigma^2}$

(3) $e^{\mu+\sigma^2}$

(4) $e^{\mu-\frac{\sigma^2}{2}}$

Q.No:22 CSIR-Dec-2023

A photon inside the sun executes a random walk process. Given the radius of the sun $\approx 7 \times 10^8$ km and mean free path of a photon $\approx 10^{-3}$ m, the time taken by the photon to travel from the centre to the surface of the sun is closest to

(1) 10^6 sec

(2) 10^{24} sec

(3) 10^{12} sec

(4) 10^{18} sec

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Q.No:23 CSIR-June-2023

A jar J_1 contains equal number of balls of red, blue and green colours, while another jar J_2 contains balls of only red and blue colours, which are also equal in number. The probability of choosing J_1 is twice as large as choosing J_2. If a ball picked at random from one of the jars turns out to be red, the probability that it came from J_1 is

(1) $\frac{2}{3}$

(2) $\frac{3}{5}$

(3) $\frac{2}{5}$

(4) $\frac{4}{7}$

Q.No:24 CSIR-June-2023

Two random walkers A and B walk on a one-dimensional lattice. The length of each step taken by A is one, while the same for B is two, however, both move towards right or left with equal probability. If they start at the same point, the probability that they meet after 4 steps, is

(1) $\frac{9}{64}$

(2) $\frac{5}{32}$

(3) $\frac{11}{64}$

(4) $\frac{3}{16}$

Q.No:25 CSIR-June-2023

An astronomer observes 500 objects and classifies them as either of type A or type B. She finds 148 objects to be of type B. Assuming a binomial distribution, the best estimate of the fraction of type A objects and its associated standard deviation respectively are:

(1) 0.704, 0.002

(2) 0.70, 0.02

(3) 0.704, 0.031

(4) 0.72, 0.03

Q.No:26 CSIR-June-2023

A random walker takes a step of unit length towards right or left at any discrete time step. Starting from $x = 0$ at time $t = 0$, it goes right to reach $x = 1$ at $t = 1$. Hereafter if it repeats the direction taken in the previous step with probability p, the probability that it is again at $x = 1$ at $t = 3$ is:

(1) $1 - p$

(2) $(1 - p)^2$

(3) $2p(1 - p)$

(4) $4p^2(1 - p)$

Q.No:27 CSIR-June-2025

A class has 60% boys and 40% girls. In an examination 8% of the boys and 12% of the girls got an 'A' grade. If a randomly selected student had an 'A' grade, what is the probability that the student is male?

(1) 0.7

(2) 0.6

(3) 0.4

(4) 0.5

Q.No:28 CSIR-June-2025

From a straight-line segment of unit length, three points are chosen at random, one after another. The probability that they are in increasing order is

(1) $\frac{1}{3}$

(2) $\frac{1}{8}$

(3) $\frac{1}{9}$

(4) $\frac{1}{6}$

Q.No:29 CSIR-June-2025

Two discrete time random walkers start from the point $x = 0$ at time $t = 0$ taking discrete steps of unit length along the x axis. The first walker is unbiased and the second walker is biased to move towards the right with probability p. The probability that they are at a distance of 2 units from each other at both time steps $t = 1$ and $t = 2$ is

(1) $\frac{1}{4}$

(2) $\frac{1}{2} - \frac{p}{2}$

(3) $1 - \frac{3p}{4}$

(4) $\frac{p}{2}$

Q.No:30 CSIR-Dec-2025

Let $p(x)$ be the probability density function for a positive real variable x, and

$$g(\alpha) = \int_0^\infty p(x)e^{-\alpha x}\,dx.$$

If $g'(\alpha)$ and $g''(\alpha)$ are respectively first and second derivatives of $g(\alpha)$ with respect to α, which of the following gives the variance of x?

1. $g''(0) - [g'(0)]^2$
2. $g''(0) + [g'(0)]^2$
3. $[g''(0) - g'(0)]^2$
4. $\frac{g''(0)}{g'(0)\,g(0)}$

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Q.No:31 CSIR-Dec-2025

A 1-dimensional random walker's displacement is always positive and is equally likely to be anywhere in the range $[L, L+b]$. After N statistically independent steps the mean distance covered by the walker is

1. NL
2. $N\sqrt{L^2+b^2}$
3. $N\left(L+\frac{b}{2}\right)$
4. $NL+b\sqrt{N}$

Q.No:32 CSIR-Dec-2025

In a heap of 20 biased coins, 17 have a 60% probability of showing heads while the other three special coins have a 90% probability of doing so. A coin is selected at random and tossed. If the result is a head, the probability that it was one of the three special coins is best approximated by

1. 0.18
2. 0.14
3. 0.21
4. 0.26

Q.No:33 CSIR-June-2026

In an experiment, a student generates 100 random numbers drawn from a uniform distribution in the interval $(0, 1)$ and calculates their mean. If the experiment is repeated 100 times, then the standard deviation of the means is:

1. $\frac{1}{20\sqrt{3}}$
2. $\frac{1}{2\sqrt{3}}$
3. $\frac{1}{\sqrt{3}}$
4. $\frac{1}{200\sqrt{3}}$

Q.No:34 CSIR-June-2026

A biased random walker confined to the x-axis moves, at each step, with probability 0.6 to the right and with probability 0.4 to the left. If the walker takes 1000 steps starting from the origin, the probability that the walker is found exactly 200 steps to the right of the origin is close to:

1. 0.026
2. 0.125
3. 0.250
4. 0.375

JEST Questions

Q.No:1 JEST-2012

An unbiased die is cast twice. The probability that the positive difference (bigger − smaller) between the two numbers is 2 is

(a) 1/9

(b) 2/9

(c) 1/6

(d) 1/3

Q.No:2 JEST-2013

Two drunks start out together at the origin, each having equal probability of making a step simultaneously to the left or right along the x axis. The probability that they meet after n steps is

(a) $\frac{1}{4^n}\frac{(2n)!}{(n!)^2}$

(b) $\frac{1}{2^n}\frac{(2n)!}{(n!)^2}$

(c) $\frac{1}{2^n}(2n)!$

(d) $\frac{1}{4^n}n!$

Q.No:3 JEST-2013

A box contains 100 coins out of which 99 are fair coins and 1 is a double-headed coin. Suppose you choose a coin at random and toss it 3 times. It turns out that the results of all 3 tosses are heads. What is the probability that the coin you have drawn is the double-headed one?

(a) 0.99

(b) 0.925

(c) 0.075

(d) 0.01

Q.No:4 JEST-2015

If two ideal dice are rolled once, what is the probability of getting at least one '6'?

(a) $\frac{11}{36}$

(b) $\frac{1}{36}$

(c) $\frac{10}{36}$

(d) $\frac{5}{36}$

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Q.No:5 JEST-2016

You receive on average 5 emails per day during a 365-days year. The number of days on average on which you do not receive any emails in that year are:

(a) More than 5

(b) More than 2

(c) 1

(d) None of the above

Q.No:6 JEST-2016

A gas contains particles of type A with fraction 0.8, and particles of type B with fraction 0.2. The probability that among 3 randomly chosen particles at least one is of type A is:

(a) 0.8

(b) 0.25

(c) 0.33

(d) 0.992

Q.No:7 JEST-2017

Suppose that we toss two fair coins hundred times each. The probability that the same number of heads occur for both coins at the end of the experiment is

(a) $\left(\frac{1}{4}\right)^{100} \sum_{n=0}^{100} \binom{100}{n}$

(b) $2\left(\frac{1}{4}\right)^{100} \sum_{n=0}^{100} \binom{100}{n}^2$

(c) $\frac{1}{2}\left(\frac{1}{4}\right)^{100} \sum_{n=0}^{100} \binom{100}{n}^2$

(d) $\left(\frac{1}{4}\right)^{100} \sum_{n=0}^{100} \binom{100}{n}^2$

Q.No:8 JEST-2019

A person plans to go from town A to town B by taking either the route ($R1 + R2$) with probability 1/2 or the route ($R1 + R3$) with probability 1/2 (see figure). Further, there is a probability 1/3 that $R1$ is blocked, a probability 1/3 that $R2$ is blocked, and a probability 1/3 that $R3$ is blocked. What is the probability that he/she would reach town B?

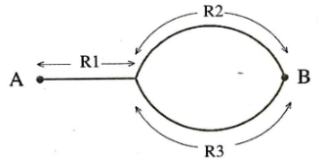


Figure 2: Routes from A to B

(a) $\frac{8}{9}$

(b) $\frac{1}{3}$

(c) $\frac{4}{9}$

(d) $\frac{2}{3}$

Q.No:9 JEST-2020

Ten persons named A, B, C, D, E, F, G, H, I, J have come for an interview. They are being called one by one to the interview panel at random. What is the probability that C gives interview before A and A gives before F?

(a) 1/6

(b) 1/10

(c) 1/8

(d) 1/4

Q.No:10 JEST-2020

If x and y have the joint probability distribution $f(x, y) = 3/4 + xy$ for $0 < x, y < 1$, and $f(x, y) = 0$ otherwise. What is the probability that y assumes a value greater than 1/2, given that x is equal to 1/2

(a) 6/16

(b) 7/16

(c) 8/16

(d) 9/16

Q.No:11 JEST-2020

A particle is moving on a one-dimensional discrete lattice with lattice spacing unity. It can move from a site to its nearest neighbour site every 1/5 seconds with p being the probability to move right and $q = (1 - p)$ being the probability to move left. Consider that the particle starts at origin, $x = 0$ at time $t = 0$. Taking $p = 3/4$, calculate the variance $\langle (x - \langle x \rangle)^2 \rangle$ at time $t = 5 \times 10^4$ seconds, where $\langle x \rangle$ is the average position.

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Q.No:12 JEST-2021

The six faces of a cube are painted violet, blue, red, green, yellow, and orange. If the cube is rolled 4 times, what is the probability that the green face appears exactly 3 times?

(a) 3/24

(b) 5/124

(c) 5/324

(d) 15/222

Q.No:13 JEST-2022

The probability that you get a sum m from a throw of two identical fair dice is P_m. If the dice have 6 (six) faces labeled by $1, 2, ...6$, which of the following statements is correct?

(a) $P_9 = P_5$

(b) $P_9 = P_4$

(c) $P_9 = P_3$

(d) $P_9 = P_6$

Q.No:14 JEST-2023

Two fair six-faced dice are thrown simultaneously. The probability that one of the dice yields an outcome that is a multiple of 2 and the other yields a multiple of 3 is:

(a) $\frac{1}{6}$

(b) $\frac{1}{3}$

(c) $\frac{13}{16}$

(d) $\frac{11}{36}$

Q.No:15 JEST-2026

A detector has a 80% particle detection efficiency. If, in a given time, 10 particles pass through the detector, what is the probability that exactly 9 particles are detected?

(A) $(0.8)^9$

(B) $2 \times (0.8)^9$

(C) $0.2 \times (0.8)^9$

(D) $(0.8)^{10}$

Q.No:16 JEST-2026

A diagnostic test for a particular disease detects it with an efficiency of 99.99% in infected people. It also detects a false positive result in 0.02% of people who are not infected. If one person in 10000 from the general population is infected, what is the probability (in nearest integer percent) that someone who tests positive is actually infected?

TIFR Questions

Q.No:1 TIFR-2015

A random number generator outputs $+1$ or -1 with equal probability every time it is run. After it is run 6 times, what is the probability that the sum of the answers generated is zero? Assume that the individual runs are independent of each other.

(a) 1/2

(b) 5/6

(c) 5/16

(d) 15/32

Q.No:2 TIFR-2016

In a triangular lattice a particle moves from a lattice point to any of its 6 neighbouring points with equal probability, as shown in the figure on the right.

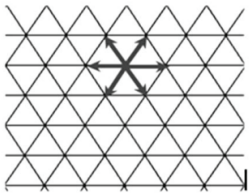


Figure 3: Triangular lattice

The probability that the particle is back at its starting point after 3 moves is

(a) 5/18

(b) 1/6

(c) 1/18

(d) 1/36

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Q.No:3 TIFR-2019

A British coin has a portrait of Queen Elizabeth II on the 'heads' side and 'ONE POUND' written on the 'tails' side, while an Indian coin has a portrait of Mahatma Gandhi on the 'heads' side and '10 RUPEES' written on the 'tails' side (see below).



Figure 4: British and Indian coins

These two coins are tossed simultaneously twice in succession.

The result of the first toss was 'heads' for both the coins. The probability that the result of the second toss had a '10 RUPEES' side is

(a) 1/2

(b) 4/7

(c) 3/5

(d) 2/3

Q.No:4 TIFR-2021

In a country, the fraction of population infected with Covid-19 is 0.2. It is also known that out of the people who are infected with Covid-19, only a fraction 0.3 show symptoms of the disease, while the rest do not show any symptoms. If you randomly select a citizen of this country, the probability that this person will **NOT** show symptoms of Covid-19 is

(a) 0.94

(b) 0.56

(c) 0.86

(d) 0.80

Q.No:5 TIFR-2022

In a standardized entrance exam, the passing rates for the past 10 years are tabulated below.

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Passing Rate	22 %	16 %	23 %	21%	22 %	14 %	17 %	20 %	24 %	21 %

Figure 5: Passing rates for past 10 years

If 1000 candidates appear for the exam every year, the probability that more than 250 students will pass the exam this year is about

(a) 6%

(b) 20%

(c) 25%

(d) 0.1%

Q.No:6 TIFR-2024

A student measures the radioactive decay of a material with a half-life of 13,000 years with a Geiger counter. In the laboratory notebook, the student records the following number of decays every 10 seconds:

158, 146, 145, 163, 154, 163, 160, 160, 152, 157, 154, 156, 149, 168, 152

The teacher suspects that the experiment was not done properly and the student created the numbers manually.

Why would the teacher have such a suspicion?

(a) The variance is much less than the mean, unlike what is expected for a Poisson distribution.

(b) The standard deviation is much less than the variance, as expected for a Poisson distribution.

(c) The median is less than the mean, unlike what is expected for a Poisson distribution.

(d) The median is greater than the mean, as expected for a Poisson distribution.

Q.No:7 TIFR-2025

For a given measurement of particles in a counter, a 10-minute data collection resulted in a statistical uncertainty of 2.5%. How much additional time must be allocated to reduce the statistical uncertainty to 0.5%?

(a) 240 minutes

(b) 40 minutes

(c) 250 minutes

(d) 50 minutes

Q.No:8 TIFR-2025

Consider a random walker on a 2D plane which starts at the origin. At every step it either moves one unit along the positive x-axis with probability 1/2 or along the positive y-axis with probability 1/2. The distance from the origin after n steps is denoted by r_n. What is the mean square displacement $\langle r_n^2 \rangle$?

(a) $n(n+1)/2$

(b) $n(n-1)/2$

(c) n^2

(d) $n(n-1)$

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Q.No:9 TIFR-2025

Consider two random variables x and y described by the joint distribution

$$P(x,y) = \frac{1}{2\pi\sqrt{1-a^2}} \exp\left(\frac{2axy - x^2 - y^2}{2(1-a^2)}\right),$$

with $0 < a < 1$.

If the above distribution is written in terms of orthogonal coordinates $z = x - y$ and $u = x + y$, the probability distribution in z is given by:

(a) A Gaussian with mean 0 and standard deviation $\sqrt{2(1-a)}$

(b) A Gaussian with mean $\sqrt{a}$ and standard deviation $\sqrt{2(1-a)}$

(c) A Gaussian with mean 0 and standard deviation $\sqrt{2(1-a^2)}$

(d) Not a Gaussian distribution

Q.No:10 TIFR-2025

Consider a particle P moving on a one-dimensional discrete lattice with lattice constant a. P can hop from one site to a neighbouring site. The probabilities of moving to the right and left are p and $q = 1 - p$, respectively. Starting from the origin $x = 0$ at time $t = 0$, what is the mean square displacement $\langle (x - \langle x \rangle)^2 \rangle$ after N steps, where $\langle x \rangle$ is the average position at time t?

(a) $4Na^2pq$

(b) $4Na^2(p-q)$

(c) $2Na^2pq$

(d) $2Na^2(p-q)$

Q.No:11 TIFR-2025

Two students perform a counting experiment independently. Student A measures the counts for 1-minute intervals each and repeats the measurement five times. The obtained counts are given below

Measurement turn	Counts
1	25
2	35
3	30
4	23
5	27

This student then takes the mean of these counts and reports the count rate (counts/min). The second student (B) makes one measurement for five minutes. She measures 145 counts and reports the count rate (counts/min). If the clock used for all these measurements is accurate up to 0.1 minutes, and there are no other sources of uncertainties, we can conclude that:

(a) The count rate reported by student A will have a larger uncertainty than that reported by student B.

(b) The count rate reported by student B will have a larger uncertainty than that reported by student A.

(c) The reported uncertainty in both results would be identical.

(d) Nothing may be concluded about the relative uncertainties between A and B.

Q.No:12 TIFR-2026

Scientists are conducting an underground experiment where two interactions, A and B can occur. In general, interaction A is twice as likely to occur compared to interaction B. Interaction A would give a signal in the detector with probability 1/8, while interaction B would give a signal with probability 1/2. If the detector registers a signal, what is the probability that the signal was due to interaction A?

(a) $\frac{1}{3}$

(b) $\frac{1}{5}$

(c) $\frac{1}{9}$

(d) $\frac{2}{3}$

GATE Questions

Q.No:1 GATE-2026

Consider the distribution of outcomes generated by N ($N \gg 1$) independent throws of (i) a coin or (ii) a six-sided dice. A coin (dice) is unbiased if both (all) its sides have equal probability to show up in a throw; it is biased otherwise. For the cases (i) and (ii) above, which of the following statements is/are true?

(A) The entropy of an unbiased coin is smaller than that of an unbiased dice.

(B) The entropy of an unbiased coin is greater than that of an unbiased dice.

(C) The entropy of a biased dice is smaller than that of an unbiased dice.

(D) The entropy of a biased coin is greater than that of an unbiased coin.

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Question No.	Entrance with year	Answer
1	CSIR Dec-2014	Option 3
2	CSIR Dec-2014	Option 1
3	CSIR June-2015	Option 3
4	CSIR Dec-2015	Option 4
5	CSIR Dec-2016	Option 4
6	CSIR Dec-2016	Option 3
7	CSIR June-2017	Option 1
8	CSIR June-2017	Option 1
9	CSIR Dec-2018	Option 3
10	CSIR June-2019	Option 3
11	CSIR Dec-2019	Option 4
12	CSIR Dec-2019	Option 2
13	Assam CSIR Dec-2019	Option 1
14	Assam CSIR Dec-2019	Option 4
15	Assam CSIR Dec-2019	Option 1
16	CSIR June-2020	Option d
17	CSIR Feb-2022	Option 4
18	CSIR Feb-2022	Option 2
19	CSIR Sep-2022	Option 4
20	CSIR Sep-2022	Option 2
21	CSIR-June-2023	Option 1
22	CSIR-Dec-2023	Option 3
23	CSIR-June-2023	Option 4
24	CSIR-June-2023	Option 3
25	CSIR-June-2023	Option 2
26	CSIR-June-2023	Option 1
27	CSIR-June-2025	Option 4
28	CSIR-June-2025	Option 4
29	CSIR-June-2025	Option 1
30	CSIR-Dec-2025	Option 1
31	CSIR-Dec-2025	Option 3
32	CSIR-Dec-2025	Option 3
33	CSIR-June-2026	Option 1
34	CSIR-June-2026	Option 1
1	JEST-2012	Option b
2	JEST-2013	Option a
3	JEST-2013	Option c
4	JEST-2015	Option a
5	JEST-2016	Option b
6	JEST-2016	Option d
7	JEST-2017	Option d
8	JEST-2019	Option c
9	JEST-2020	Option a
10	JEST-2020	Option d
11	JEST-2020	7500
12	JEST-2021	Option c
13	JEST-2022	Option a
14	JEST-2023	Option d
15	JEST-2026	Option B
16	JEST-2026	33

Question No.	Entrance with year	Answer
1	TIFR-2015	Option c
2	TIFR-2016	Option c
3	TIFR-2019	Option a
4	TIFR-2021	Option a
5	TIFR-2022	Option a
6	TIFR-2024	Option a
7	TIFR-2025	Option a
8	TIFR-2025	Option a
9	TIFR-2025	Option a
10	TIFR-2025	Option a
11	TIFR-2025	Option a
12	TIFR-2026	Option a
1	GATE-2026	Option A,C

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