

	Continuous Probability Distributions
Q#(1).	<p>Suppose that the counts recorded by a Geiger counter with an average of two counts per minute.</p> <p>(a) What is the probability that the first count occurs in less than 10 seconds?</p> <p>(b) What is the probability that the first count occurs between one and two minutes after start-up?</p>
Q#(2).	<p>The time between arrivals of taxis at a busy intersection is exponentially distributed with a mean of 10 minutes.</p> <p>What is the probability that you wait longer than one hour for a taxi?</p>
Q#(3).	<p>Requests for service in a queuing model has a mean of five per unit time.</p> <p>What is the probability that the time until the first request is less than 4 minutes?</p>
Q#(4).	<p>The time to prepare a micro-array slide for high-throughput genomics has a mean of two hours per slide. What is the probability that 10 slides require more than 25 hours to prepare?</p> <p>0.2014</p>
Q#(5).	<p>The time between failures of a laser in a cytogenics machine has a mean of 25,000 hours.</p> <p>(a) What is the expected time until the second failure?</p> <p>(b) What is the probability that the time until the third failure exceeds 50,000 hours?</p>
Q#(6).	<p>In a data communication system, several messages that arrive at a node are bundled into a packet before they are transmitted over the network. Assume that the messages arrive at the node at an average 30 messages per minute. Five messages are used to form a packet.</p> <p>(a) What is the mean time until a packet is formed, that is, until five messages have arrived at the node?</p> <p>(b) What is the probability that a packet is formed in less than 10 seconds?</p> <p>(c) What is the probability that a packet is formed in less than five seconds?</p>
Q#(7).	<p>The time between arrivals of customers at an automatic teller machine has a mean of five minutes.</p> <p>What is the probability that the time until the fifth customer arrives is less than 15 minutes?</p>
Q#(8).	<p>Patients arrive at a hospital emergency department with a mean of 6.5 per hour</p> <p>(a) What is the mean time until the 10th arrival?</p> <p>(b) What is the probability that more than 20 minutes is required for the third arrival?</p>

Q#(9).	<p>Assume that the time X required for a runner to run a mile is a normal random variable with mean 4 minutes and standard deviation 2 minutes. What is the probability that this athlete will run the mile in</p> <p>i) Less than 4 minutes (ii) Atleast 3 minutes (iii) Not more than 5 minutes (iv) between 3 to 5 minutes</p> <p>Answers (i) 0.5 (ii) 0.6915 (iii) 0.6915 (iv) 0.3829</p>
Q#(10).	<p>The marks obtained by the students are normally distributed with a mean of 60 marks and standard deviation of 10 marks. Find the probability that a student selected at random obtains marks</p> <p>(i) More than 75 (ii) Less than 56 (iii) Between 50 and 70</p> <p>Answers (i) 0.0668 (ii) 0.3446 (iii) 0.6827</p>
Q#(11).	<p>The diameters of bolts manufactured by a company are normally distributed with mean 0.25 inches and standard deviation 0.02 inches. A bolt is considered defective if its diameter < 0.20 or > 0.28 inches. Find the total number of defective bolts out of 5, 000 bolts manufactured by the company.</p> <p>Answers :- $0.0062+0.06681=0.0730$ (365 defective bolts)</p>
Q#(12).	<p>The mean life of stocking used by an army was 40 days with a standard deviation of 8 days. Assume the life of the stockings follows a normal distribution. If 100,000 pairs are issued, how many would replacement after 46 days</p> <p>Answers :- $0.7734 \times 100000 = 77340$</p>
Q#(13).	<p>If IQ's for adult Pakistanis are normally distributed with mean =100 and standard deviation equal to 10. If an individual with an IQ of 110 or above is classified as genius, then what percent of Pakistanis is genius?</p> <p>Answers :- 0.1587 i.e 15.87%</p>
Q#(14).	<p>A buyer of logs from a wood company must determine whether to buy a piece of land containing 5000 pine trees. If 1000 of the trees are atleast 40 feet tall the buyer will purchase the land; otherwise he will not. The owner of the land reports that the distribution of heights of the trees is normal with mean and variance of 30 feet and 16 feet respectively. Based on this information what should the buyer decide</p> <p>Answers :- 0.0062 i.e $0.0062 \times 5000 = 31$ trees with height atleast 40 feet</p>

Q#(15).	<p>The time taken by a milk man to deliver milk in a certain locality is normally distributed with mean 12 minutes and standard deviation 2 minutes. He delivers milk every day. Estimate the number of days during three years when he takes</p> <ol style="list-style-type: none"> 1. Longer than 17 minutes 2. Less than 10 minutes 3. Between 9 and 13 minutes 4. Greater than the mean time to deliver milk. <p>Answers (i) 0.0062 (7 days) (ii) 0.1586 (174 days) (iii) 0.6247 (684 days) (iv) 0.50 (548 days)</p>
Q#(16).	In a DNA sequence, the probability of a mutation occurring at a single base is 1 in 1,000 . What is the probability that the first mutation is observed at the 20th base ?
Q#(17).	A restriction enzyme recognizes a specific 4-base sequence (e.g., "AGCT"). Assuming that each base (A, G, C, T) appears independently and with equal probability ($p = 0.25$ for each base), what is the probability that the enzyme will encounter its restriction site for the first time at the 8th position in the DNA sequence?
Q#(18).	In a DNA sequence of 1,000 bases , the probability of a mutation at any given base is 0.001. What is the probability of observing exactly 3 mutations in the sequence?
Q#(19).	In a genome, 20% of genes are known to have a particular motif. If a sample of 15 genes is selected randomly, what is the probability that exactly 5 genes contain the motif?
Q#(20).	In a high-throughput sequencing experiment, the error rate for a base is 0.01 . For a read of 100 bases , what is the probability of observing no errors ?
Q#(21).	In a random DNA sequence of 300 codons , the probability of observing a specific codon (e.g., "ATG") at any position is $p=0.05$. What is the probability of observing at least 10 "ATG" codons ?
Q#(22).	Suppose mutations occur in a DNA sequence at an average rate of 2 mutations per 1,000 bases . What is the probability of observing exactly 3 mutations in a 1,000-base segment?
Q#(23).	A transcription factor binds to DNA randomly, with an average rate of 5 binding sites per 10,000 bases . What is the probability of finding 0 binding sites in a randomly selected 10,000-base region?
Q#(24).	A rare mutation occurs in a population of cells at an average rate of 0.01 mutations per cell . If you sample 500 cells , what is the probability of observing exactly 5 mutations ?
Q#(25).	A protein binds randomly to DNA at an average rate of 3 bindings per second . What is the probability that the time until the next binding is less than 0.5 seconds ?
Q#(26).	A certain regulatory signal activates genes at an average rate of 4 activations per hour . What is the probability that the first activation occurs within 15 minutes ?
Q#(27).	A protein binds to a DNA sequence with a rate of 0.1 binding events per second . What is the probability that the time until the 3rd binding occurs is greater than 10 seconds?
Q#(28).	A gene is activated at an average rate of 0.2 activations per minute . What is the probability that the time until the 4th activation is less than 15 minutes ?

Q#(29).	Gene expression levels in a sample of cells follow a normal distribution with a mean of 100 units and a standard deviation of 15 units . What is the probability that a randomly chosen cell has an expression level between 85 and 115 units ?
Q#(30).	A protein concentration in a cell follows a normal distribution with a mean of 50 ng/mL and a standard deviation of 5 ng/mL . What is the probability that the protein concentration is greater than 55 ng/mL ?