

1. If Z is a standard Normal variable, find:
 - a) $P(1.62 < Z < 2.37)$
 - b) $P(-0.68 < Z < 0)$
 - c) $P(-1.64 < Z < -1.02)$
 - d) $P(-0.59 < Z < 1.33)$
2. If $Z \sim N(0,1)$, determine the value of a in each of the following:
 - a) $P(Z < a) = 0.75$
 - b) $P(-a < Z < a) = 0.8$
 - c) $P(Z < a) = 0.05$
 - d) $P(a < Z < -1.5) = 0.0418$
3. If X is normally distributed, calculate:
 - a) $P(4.5 < X < 6.5)$ where $\mu = 5$ and $\sigma = 3$;
 - b) $P(X < 800)$ where $\mu = 500$ and $\sigma = 200$
4. The length of rods in a large batch is normally distributed with the mean 120 mm and standard deviation 1.5 mm. What percentage of the rods would you expect to measure
 - a) over 122.5 mm
 - b) between 116 mm and 124 mm
5. A maintenance engineer has established that component XYZ has an average operating life of 2500 hours and a standard deviation of 250 hours. Assuming a normal distribution, calculate the probability that anyone component XYZ chosen at random would have an operating life
 - a) less than 2200 hours,
 - b) between 2300 and 2700 hours,
 - c) between 2300 and 2400 hours,
 - d) more than 3000 hours.
6. Candidates' marks in an examination in Statistics were found to have a mean of 50 percent and a standard deviation of 10 percent. The marks were normally distributed. What proportion of candidates had marks
 - a) above 70 percent
 - b) below 40 percent
7. A certain type of cabbage has a mass which is normally distributed with mean 1 kg and standard deviation 0.15 kg. In a lorry load of 800 of these cabbages, estimate how many will have mass
 - a) greater than 0.79 kg
 - b) between 0.85kg and 1.15kg
8. The weight of a particular brand of cereal in a packet can be approximated to a normal distribution with a mean of 500 grams and a standard deviation of 10 grams.
 - a) Find the probability that a randomly selected packet will contain between 505 and 515 grams of cereal.
 - b) Determine the weight of cereal such that 10% of the packets are containing weights more than this.
9. The lengths of certain item follow a normal distribution with mean μ cm and standard deviation 6 cm. It is known that 4.75% of the items have a length greater than 82 cm. Find the value of the mean μ .

10. The weight of a randomly chosen grape of a given variety may be taken to be a normal variable with mean 5g. Find the standard deviation, in grams, given that the probability that a randomly chosen grape weights less than 3g is 0.123. Give your answer correct to two places of decimals. Show that the probability that a randomly chosen grape weights more than 9 is 0.0102.
11. The probability that a pen drawn at random from a box of pens is defective is 0.1. If a sample of 6 pens is taken. find the probability that it will contain
 - a) no defective pens
 - b) 5 or 6 defective pens
 - c) less than 3 defective pens
12. Over a long period of time a drug has been effective in 40% of cases in which it has been prescribed. If 4 patients are treated by this drug, find the probability that it will be effective for
 - a) at least 3 patients
 - b) none of the patients
 - c) 1 or 2 patients
13. A large batch of toys contains 20% defectives. They are sold in packets each containing six toys. What is the probability that
 - a) a purchaser will receive a packet containing three or more defectives?
 - b) if on complaining, he receives another packet, it will contain no defectives?
14. A shoe store's records show that 30% of customers making a purchase use credit cards to make payment. This morning, 20 customer purchased shoes from the store.
 - a) What is the probability that at least 3 customers, but not more than 6, used credit cards?
 - b) What is the expected number of customers who used credit cards?
 - c) Find the probability that exactly 14 customers did not use credit cards.
15. 10% of males suffer from a certain disease. Use the normal approximation to Binomial distribution to find the probability that more than 60 men in a randomly selected group of 500 will suffer from the disease.
16. 10% of the chocolates produced in a factory are mis-shapes. In a sample of 1000 chocolates, find the probability that the number of mis-shapes is
 - a) less than 80,
 - b) between 90 and 115 inclusive
 - c) 120 or more
17. Suppose that the proportion of engines which contain a defect in an assembly operation is 0.10, and a sample of 200 engines is included in a particular shipment. What is the probability that at least 30 of the 200 engines contain a defect?
18. An insurance company receives on average 2 claims per week from a certain factory. Assuming that the number of claims follows a Poisson distribution, find the probability that it receives
 - a) more than 3 claims in a given week,
 - b) more than 2 claims in a given fortnight,
 - c) no claims on a given day, assuming that the factory operates on a 5-day week.

19. Cars arrive at a petrol station at an average rate of 30 per hour. Assuming that the number of cars arriving at the petrol station follows a Poisson distribution, find the probability that
- more than 3 cars arrive during a 5- minute interval,
 - more than 2 cars arrive in a 15- minute interval,
 - less than 3 cars arrive during a 10- minute interval.
20. During the summer months (June to August inclusive), an average of 5 marriages per month take place in a small city. Assuming that these marriages occur randomly and independently of one another, find the following probabilities
- Fewer than 3 marriages will occur in June,
 - At least 14 but not more than 18 marriages occur during the entire 3 months of summer,
 - Exactly 10 marriages occur during the 2 months of July and August.

Answer:

Q1.	(a)	0.04371	(b)	0.2517	(c)	0.1034	(d)	0.6306
Q2.	(a)	0.6745	(b)	1.2816	(c)	-1.6449	(d)	-1.96
Q3.	(a)	0.259	(b)	0.9332				
Q4.	(a)	4.75%	(b)	99.24%				
Q5.	(a)	0.1151	(b)	0.5762	(c)	0.1327	(d)	0.02275
Q6.	(a)	0.02275	(b)	0.1587				
Q7.	(a)	735	(b)	546				
Q8.	(a)	0.2417	(b)	512.82				
Q9.		72						
Q10.		1.72 g						
Q11.	(a)	0.5314	(b)	5.5×10^{-5}	(c)	0.9841		
Q12.	(a)	0.1792	(b)	0.1296	(c)	0.6912		
Q13.	(a)	0.0989	(b)	0.2621				
Q14.	(a)	0.5725	(b)	6	(c)	0.1916		
Q15.		0.0582						
Q16.	(a)	0.01539	(b)	0.8149	(c)	0.0197		
Q17.		0.01255						
Q18.	(a)	0.1429	(b)	0.7619	(c)	0.67		
Q19.	(a)	0.2424	(b)	0.9797	(c)	0.1247		
Q20.	(a)	0.1247	(b)	0.4561	(c)	0.1251		