1. What is normal distribution? Describe characteristics of normal distribution.

2. What is standardized normal distribution? Write down its importance.

3. Describe normal distribution as approximation of binomial distribution and poisson distribution.

4. What is exponential distribution? Describe characteristics of exponential distribution.

5. What is gamma distribution? Write down characteristics of gamma distribution

6. Suppose X follows the normal distribution with mean 100 and standard deviation 10, find the probability that (a) X is between 100 and 110 (b) X is more than 120 (c) X is less than 115 (d) X is between 80 and 100 (e) X is less than 80 (f) X is more than 90 (g) X is between 112 and 130 (h) X is between 85 and 125 (i) X is between 75 and 95.

**[Ans: 0.341, 0.022, 0.833, 0.477, 0.028, 0.841, 0.113, 0.926, 0.302]**

7. The monthly production of certain types of computer parts of a company was found to be normally distributed with mean number of computer parts 100,000 with a standard deviation of 20,000. Find the probability that the monthly production of computer parts is (i) more than 120,000; (ii) less than 125,000; (iii) more than 60,000; (iv) less than 80,000; (v) between 105000and 130,000. **[Ans: 0.158, 0.894, 0.977, 0.658, 0.295]**

8. The local authorities in a certain city install 1000 pen drives to provide in different organizations of city. If these pen drives have an average life of 1000 hours with a standard deviation of 200 hours, assuming normality, what number of pen drives might be expected to fail (i) in the first 800 hours ? (ii) between 800 and 1,200 hours ? After what period of time would you expect that (a) 10% of the pen drives would fail? (b) 10% of the pen drives would be still working. **[Ans:159, 683, 744, 1256]**

9. The life time of a certain electronic component in a normal random variate with the expectation of 5000 hours and a standard deviation of 100 hours. Compute the probabilities under the following conditions

a) Life time of components is less than 5012 hours

b)Lifetime of components between 4000 to 6000 hours

c) Lifetime of components more than 7000 hours

**[Ans: 0452, 0.998, 0]**

10. Suppose that life of battery used in laptop of a software company is normally distributed with a mean of 40 months and a standard deviation of 5 months. If at a time, 1000 batteries are issued, how many will need the replacement after 35 months? **[Ans: 841]**

11. Incomes of a group of 10,000 computer operators were found to be normally distributed with mean Rs. 15,200 and standard deviation Rs. 1600, find (i) highest income of poorest 2000 computer operators (ii) lowest income of richest 1000 computer operators.

**[Ans: 1385.6, 1724.8]**

12. The marks obtained by 5000 students in an examination are normally distributed with mean 65 and variance 400. Estimate (i) lowest mark of top 10% students; (ii) highest marks of poorest 500 students; (iii) the limits of marks of middle 80% students.

**[Ans: 73.09, 56.91, 56.91-73.09]**

13. In an examination it is laid down that a student passes if he secures 30 per cent or more marks. He is placed in the first, second or third division according as he secures 60% or more marks, between 45% and 60% marks und marks between 30% and 45% respectively. He gets a distinction in case he secures 80% or more marks. It is noticed from the results that 10% of the students failed in the examination, whereas 5% of them obtained distinction. Calculate the percentage of students placed in the second division. (Assume normal distribution of marks.) **[Ans: 34%]**

14. The life of printers follows a normal distribution with mean H hours and a standard deviation of 200 hours. It is known that 10% of the printers have a life less than 400 hours. Find the mean life of the printers. **[Ans: 656]**

15. Sacks of grain packed by an automatic machine loader follow normal distribution having an average weight of 114 kgs. It is found that 15% of bags are over 115 kgs. Find the standard deviation.**[Ans: 0.96]**

16. In examination, it was observed that 10% of the candidates got first division and 30% failed. The pass marks is 40 out of 100 and first division marks is 60 out of 100. Assuming that the marks follow normal distribution, find the mean and standard deviation of the distribution.**[Ans: 45.78, 11.11]**

17. A printer can print 15 pages per minute or average. Using normal distribution as approximation of Poisson distribution find probability that printer can print (i) more than 25 pages per minute (ii) less than 10 pages per minute. **[Ans: 0.242, 0.359]**

18. Suppose that waiting time (hrs) for bus in a bus station has a negative exponential distribution with parameters θ= 5 hours. What is the probability that a man has to wait at least 15 minutes? Also find expected waiting time for bus. **[Ans: 0.28, 1/5hr]**

19. The daily consumption of electricity in a city has an exponential distribution with mean 2000 kilowatt. Find the probability that electricity consumption on a particular day is (i) at least 1500 kilowatt (ii) at most 2500 kilowatt. **[Ans: 0.47, 0.713]**

20. The life time of Lenovo cell phone has gamma distribution with parameter 2. Find the probability that cell phone has life (i) more than 2 years (ii) Between 3 years to 5 years**[Ans:0.405, 0.159]**

21. Jobs are sent to a printer following exponential distribution at an average rate of 3 jobs per hour. i)What is expected time between jobs?ii)What is probability that the next job is sent within 5 minutes? **[Ans:0.1/3 hrs,0.22]**

**22.** Life time of computer memory chips have Gamma distribution with expectation 12 years and variance 16 years . What is probability that such a chip has a lifetime between 8 and 10 years? **[Ans:0.185]**

23. Fit normal distribution to the following data and find expected frequencies.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Class | 20 – 30 | 30 –40 | 40 – 50 | 50 – 60 | 60 - 70 | 70 -80 | 80 - 90 | 90- 100 |
| frequency | 1 | 3 | 16 | 34 | 28 | 14 | 3 | 1 |

**24.** Fit negative exponential distribution to following data and find expected frequencies

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Decay time | 0 – 0.5 | 0.5 – 1 1 | 1 – 1.5 | 1.5 – 2 | 2 – 2.5 | 2.5 – 3 | 3 – 3.5 |
| No. of particles | 100 | 74 | 50 | 40 | 28 | 20 | 8 |