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| **Mathematics for Data Science 2023/24** |

**Week-9 Discrete Variable Distributions**

**Answer the following questions**

1. Discrete Random variables have countable values. (True or False)

Answer: True

2. Classify each random variable as either discrete or continuous

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1. The time between customers entering a checkout lane at a retail store.
2. The weight of refuse on a truck arriving at a landfill.
3. The number of passengers in a passenger vehicle on a highway at rush hour.
4. The number of clerical errors on a medical chart.

Answer: a. Continuous

c. Discrete

d. Discrete

3. Determine whether or not the table is a valid probability distribution of a discrete random variable. Explain fully.

Table

Description automatically generated

Answer : Table 1 Invalid

Table 2 Invalid

Table 3 Invalid

4. A discrete random variable 𝑋 has the following probability distribution :

Table

Description automatically generated

Compute each of the following quantities.

1. 𝑃(80)
2. 𝑃(𝑋>80)
3. 𝑃(𝑋≤80)
4. The mean 𝜇 of 𝑋
5. The variance 𝜎2 of 𝑋
6. The standard deviation 𝜎 of 𝑋

Answers:

a. 0.4

b. 0.1

c. 0.9

d. 79.15

e. 𝜎2=1.5275

f. 𝜎=1.2359

5. Determine whether or not the random variable 𝑋 is a binomial random variable. If so, give the values of 𝑛n and𝑝p. If not, explain why not.

* 1. 𝑋X is the number of dots on the top face of fair die that is rolled.
  2. 𝑋X is the number of hearts in a five-card hand drawn (without replacement) from a well-shuffled ordinary deck.
  3. 𝑋X is the number of defective parts in a

sample of ten randomly selected parts coming from a manufacturing process in which 0.02%0.02% of all parts are defective.

* 1. 𝑋X is the number of times the number of dots on the top face of a fair die is even in six rolls of the die.
  2. 𝑋X is the number of dice that show an even number of dots on the top face when six dice are rolled at once.

Answer:

1. not binomial; not success/failure.
2. not binomial; trials are not independent
3. binomial; 𝑛=10,𝑝=0.0002
4. binomial; 𝑛=6,𝑝=0.5
5. binomial; 𝑛=6,𝑝=0.5

6. An English-speaking tourist visits a country in which 30%30% of the population speaks English. He needs to ask someone directions.

1. Find the probability that the first person he encounters will be able to speak English.
2. The tourist sees four local people standing at a bus stop. Find the probability that at least one of them will be able to speak English.

Answer : a. 0.3

b. 0.7599

7.  If a patient is waiting for a suitable blood donor and the probability that the selected donor will be a match is 0.2, then find the expected number of donors who will be tested till a match is found including the matched donor.  
**Solution:** As we are looking for only one success this is a geometric distribution.  
p = 0.2  
E[X] = 1 / p = 1 / 0.2 = 5  
**Answer:** The expected number of donors who will be tested till a match is found is 5 (including the donor).

8. Suppose you are playing a game of darts. The probability of success is 0.4. What is the probability that you will hit the bullseye on the third try?  
**Solution:** As we are looking for the first success, thus, geometric distribution has to be used.  
p = 0.4  
P(X = x) = (1 - p)x - 1p  
P(X = 3) = (1 - 0.4)3 - 1(0.4)  
P(X = 3) = (0.6)2(0.4) = 0.144  
**Answer:** The probability that you will hit the bullseye on the third try is 0.144