University of mysore, manasagangothri

DOS OF COMMERCE AND MANAGEMENT

SUB:STATISTICS ON BUSINESS DECISIONS

PRESENTATION ON

PROBLEMS ON BINOMIAL DISTRIBUTION

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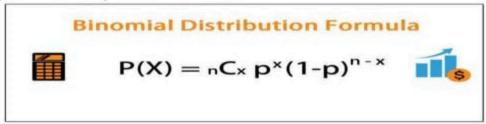
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Introduction

- Binomial distribution was discovered by JAMES BERNOILLI in 1738.
- This is a discrete probability distribution.
- A discrete probability distribution (applicable to the scenarios where the set of possible outcomes is <u>discrete</u>, such as a coin toss or a roll of dice) can be encoded by a discrete list of the probabilities of the outcomes, known as a <u>probability mass function</u>.

DEFINITION OF BINOMIAL DISTRIBUTION

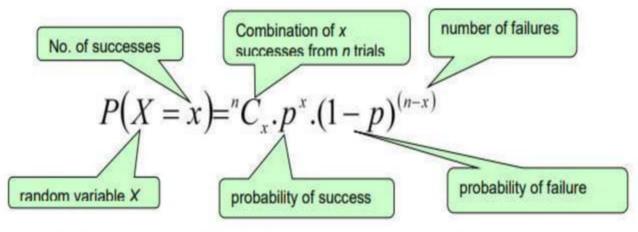
 If 'X' is a discrete random variable with probability mass function



Where x=0,1,2,3.....n & q=1-p, then 'X' is a binomial variate and the distribution of 'X' is called binomial distribution.

What is binomial distribution?

- The word "binomial" literally means "two numbers." A binomial distribution for a random variable X (known as binomial variate) is one in which there are only two possible outcomes, success and failure, for a finite number of trials.
- Note that however we define success and failure, the two events must be mutually exclusive and complementary; that is, they cannot occur at the same time (mutually exclusive), and the sum of their probabilities is 100% (complementary).



- Where p,q should be greater than 1
- p+q=1 because probability cannot be more than 1
- X is a discrete random variable which may take on only countable number of distinct values such as 1,2,3,4....

Assumptions for binomial distribution

- > For each trial there are only two possible outcomes on each trial, S (success) & F (failure).
- The number of trials 'n' is finite.
- ➤ For each trial, the two outcomes are mutually exclusive .
- P(S) = p is constant. P(F) = q = 1-p.
- ➤ The trials are independent, the outcome of a trial is not affected by the outcome of any other trial.
- The probability of success, p, is constant from trial to trial.

Problems

Example 1: A quiz consists of 10 multiple-choice questions. Each question has 5 possible answers, only one of which is correct. Pat plans to guess the answer to each question. Find the probability that Pat gets

- a. one answer correct.
- b. all 10 answers correct.

Solution:
$$n = 10, p = .2$$

a.
$$P(1) = \frac{10!}{1!(10-1)!}(.2)^1(1-.2)^{10-1} = 10(.2)(.8)^9 = .2684$$

b.
$$P(10) = \frac{10!}{10!(10-10)!}(.2)^{10}(1-.2)^{10-10} = 1(.2)^{10}(1) = .0000001$$

Binomial distribution



Example: The probability that a baby is born a boy is 0.51. A mid-wife delivers 10 babies. Find:

 $=(^{10}C_8 \times 0.51^8 \times 0.49^2)+(^{10}C_9 \times 0.51^9 \times 0.49)+0.51^{10}$

- a) the probability that exactly 4 are male;
- b) the probability that at least 8 are male.
- a) $P(X = 4) = {}^{10}C_4 \times 0.51^4 \times 0.49^6 = 0.197$

= 0.0621





b) $P(X \ge 8) = P(X = 8) + P(X = 9) + P(X = 10)$

= 0.04945 + 0.01144 + 0.00119

Example3:In a college 20% of students are girls. In a random sample of 5 students, find the probability that there are at most 2 girls?

Solutuion: Let X be the binomial variate denoting number of girls with the parameters n=5 p=20/100=0.2

$$P(X=x)=nC_x p^x q^{n-x}$$

$$P(X<=2)=p(x=0)+p(x=1)+p(x=2)$$

$$=5C_0 (0.2) (0.8)^5 +5C_1 (0.2)^1 (0.8)^4 + 5C^2 (0.2)^2 (0.8)^3$$

$$= 0.32768+0.4096+0.2048$$

$$= 0.94208$$

Conclusion

- The binomial distribution is a discrete probability distribution used when there are only two possible outcomes for a random variable: success and failure.
- Success and failure are mutually exclusive; they cannot occur at the same time. The binomial distribution assumes a finite number of trials, n.
- For the binomial distribution to be applied, each successive trial must be independent of the last; that is, the outcome of a previous trial has no bearing on the probabilities of success on subsequent trials.

- For example, if a new drug is introduced to cure a disease, it either cures the disease (it's successful) or it doesn't cure the disease (it's a failure).
- If you purchase a lottery ticket, you're either going to win money, or you aren't.
- A machine is known to produce, on average, 2% defective components. As an engineer you might need to know the probability that 3 items are defective in the next 20 produced.
- Basically, anything you can think of that can only be a success or a failure can be represented by a binomial distribution.



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1 ST YEAR Mcom "B"