

University of mysore,manasagangothri


DOS OF COMMERCE AND MANAGEMENT

SUB:STATISTICS ON BUSINESS DECISIONS
»»

PRESENTATION ON

PROBLEMS ON BINOMIAL
DISTRIBUTION

CONTENTS

- ▶ Introduction
 - ▶ What is binomial distribution?
 - ▶ Definition of binomial distribution
 - ▶ Assumptions of binomial distribution
 - ▶ Problems
 - ▶ Conclusion
 - ▶ References
- 

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 discrete, 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 probability mass function.

DEFINITION OF BINOMIAL DISTRIBUTION

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

Binomial Distribution Formula



$$P(X) = {}_n C_x p^x (1-p)^{n-x}$$



- ▶ Where $x=0,1,2,3,\dots,n$ & $q=1-p$, 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).

No. of successes

Combination of x
successes from n trials

number of failures

$$P(X = x) = {}^n C_x \cdot p^x \cdot (1-p)^{(n-x)}$$

random variable X

probability of success

probability of failure

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

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

- a) the probability that exactly 4 are male;
- b) the probability that at least 8 are male.

a) $P(X = 4) = {}^{10}C_4 \times 0.51^4 \times 0.49^6 = 0.197$

b) $P(X \geq 8) = P(X = 8) + P(X = 9) + P(X = 10)$
 $= ({}^{10}C_8 \times 0.51^8 \times 0.49^2) + ({}^{10}C_9 \times 0.51^9 \times 0.49) + 0.51^{10}$
 $= 0.04945 + 0.01144 + 0.00119$
 $= 0.0621$



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 $n=5$ $p=20/100=0.2$

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

$$\begin{aligned}P(X \leq 2) &= p(x=0) + p(x=1) + p(x=2) \\ &= 5C_0 (0.2)^0 (0.8)^5 + 5C_1 (0.2)^1 (0.8)^4 + 5C_2 (0.2)^2 (0.8)^3 \\ &= 0.32768 + 0.4096 + 0.2048 \\ &= 0.94208\end{aligned}$$

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.
- 



Thank You

By >>

SUSHMITA R GOPINATH
1ST YEAR Mcom "B"