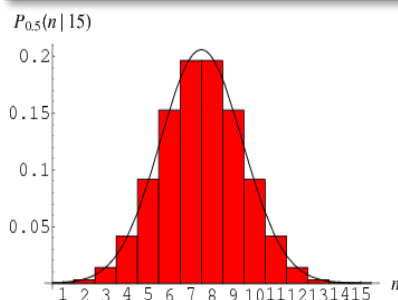


Goals



By the end of this week, you should be able to:

- understand probability distributions for discrete random variables
- understand Bernoulli trials
- understand binomial theorem and binomial probability distribution
- recognise situations when the binomial distribution applies and learn how to solve problems involving the binomial distribution
- recognise and use the formula and CAS for binomial probabilities and graphs
- understand the assumptions on which the binomial model is based

Theoretical Components

Resources:

- Maths Quest Year 12 Chapter 11

Read through Section 11A, 11B & 11C on Binomial Distributions. Study and make notes on examples 1-10.

<https://www.youtube.com/watch?v=xNLQuuvE9ug>

<https://www.youtube.com/watch?v=WWv0RUxDfbs>

<http://stattrek.com/probability-distributions/binomial.aspx>

$\Pr(X = x) = {}^n C_x p^x q^{n-x}$ where $x = 0, 1, 2, \dots, n$.
That is:

x = the occurrence of the successful outcome.

The formula may also be written as:

$\Pr(X = x) = {}^n C_x p^x (1 - p)^{n-x}$ where $x = 0, 1, 2, \dots, n$.

Here, the probability of failure, q , is replaced by $1 - p$.

Practical Components

Complete the following questions. Organise your solutions neatly in your exercise book.

You will require Chapter 11 of Maths Quest Methods (pdf – Google Classroom).

Ex 11A The binomial distribution

- Qs 3, 5, 7, 11, 14, 15, 23, 29

Ex 11B Problems involving the binomial distribution for multiple probabilities

- Qs 2, 4, 9, 11, 13, 21, 22, 28

Ex 11D Expected value, variance, and standard deviation of the binomial distribution

- Qs 2, 4, 6, 8, 10, 12, 14, 16, 22, 24, 28

Investigation

See the following page.

QFO

Quiz/Forum/Other

Make sure you have completed all the practical exercise, any Cambridge tasks and Investigations. Start preparing for your exam in Week 19. Hand-written summary sheet allowed – 2 sides of A4. See the end of the brief for Knowledge Checklist. Be sure to regularly check the Google Classroom for messages and links.



The binomial distribution

- The binomial distribution is an example of a specific type of discrete probability distribution. It has the distinct characteristics:
 1. A fixed number of n identical trials are conducted.
 2. Each trial is independent.
 3. There are only two possible outcomes for each trial: a success, p , and a failure, q .
- The binomial distribution may be referred to as a Bernoulli distribution, and the trials conducted are known as Bernoulli trials.
- If X represents a random variable which has a binomial distribution then it can be expressed as $X \sim \text{Bi}(n, p)$ or $X \sim \text{B}(n, p)$. This means that X follows a binomial distribution with parameters n (the number of trials) and p (the probability of success).
- If X is a binomial random variable its probability is defined as:

$$\Pr(X = x) = {}^n C_x p^x q^{n-x} \text{ where } x = 0, 1, 2, \dots, n$$

The effects of n and p on binomial distribution graphs

- The parameters n and p affect the binomial probability distribution curve as follows.
 1. If $p < 0.5$, the graph is positively skewed, or skewed to the right.
 2. If $p = 0.5$, the graph is symmetrical or is a normal distribution curve.
 3. If $p > 0.5$, the graph is negatively skewed, or skewed to the left.
 4. When n is large and $p = 0.5$, the interval between the vertical columns decreases and the graph approximates a smooth hump or bell shape.

Problems involving the binomial distribution for multiple probabilities

- When solving problems dealing with the binomial distribution for multiple probabilities always:
 1. write down what is required
 2. write down the rule for the binomial probability distribution
 3. substitute the values into the given rule and evaluate.

Expected value, variance and standard deviation of the binomial distribution

- If X is a random variable and $X \sim \text{Bi}(n, p)$ then:

$$E(X) = np$$

$$\text{Var}(X) = npq$$

$$\text{SD}(X) = \sqrt{npq}$$

This applies only for a binomial distribution.



MM3 Week 17/18 Investigation

The winner of the baseball World Series championship is determined through a best-of-seven playoff.

In 1996 the Atlanta Braves beat the New York Yankees in the first two games of the World Series.

Assuming that either team was equally likely to win each game:

- What was the chance of a Yankee comeback? i.e. winning the series?
- What is the probability that the Yankees beat the Braves in the third, fourth, fifth and sixth games?
- Compare and comment on the probabilities calculated.

Who won the 1996 World Series? (- Do some research)
Comment on the result.



Knowledge Checklist

Integration

- Revision of antidifferentiation
- Integration of e^x , $\sin x$ and $\cos x$
- Integration by recognition
- Approximating areas enclosed by functions
- The fundamental theorem of integral calculus
- Areas between the curve and the x-axis
- Areas between 2 curves
- Further applications of integration

Discrete Random Variables

- Discrete random variables
- Expected value
- Variance and standard deviation

The Binomial Distribution

- n trials, success/failure
- Probabilities
- Expected value
- Variance
- Standard deviation

Chapter Reviews Maths Quest 12 Methods

Chapter 9 – Integration

Chapter 10 – Discrete Random Variables

Chapter 11 – The Binomial Distribution