Starter

1) Complete the probability distribution function.

x	4	5	6
P(X = x)	0.2		0.45

2) For the table above calculate E(X) and Var(X)

Aug 21-15:35

Binomial Distribution

Today we are learning...

What the binomial distribution is and how we use it.

I will know if I have been successful if...

I know what the Binomial Distribution is.

I understand the conditions that must be met to use it.

I can calculate probabilities using it.

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The Binomial Distribution

The binomial distribution is a special discrete probability distribution.

If X~Bin(n, p) then:

$$P(X = x) = \begin{cases} \binom{n}{x} p^x q^{n-x} & \text{for } x = 0, 1, 2, \ldots, n \\ 0 \text{ otherwise} & \end{cases}$$

where $0 < p < 1$ and $q = 1 - p$

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Binomial Distribution

The Binomial Distribution can be used to calculate probabilities of certain experiments. The following conditions must be met when using the binomial distribution.

1) There are a fixed number of trials, n.

2) There only two outcomes, "success" and "failure".

3) The trials are **independent**.

4) There is a constant probability of success p.

5) The random variable, X, is the total number of successes in n trials.

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Common Examples

Common examples of experiments where the binomial distribution can be used to calculate probabilities are:

a) Flipping a coin 5 times and counting the number of heads we get.

b) Rolling a dice 8 times and counting the number of times we get an even number.

c) Picking a counter out of bag of 4 red and 3 green and getting a green 3 times when you conduct the experiment 6 times.

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Let's look at the formula in more detail...

If $X \sim Bin(n, p)$

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

Takes into account all the different orders in which something can happen.

where $0 < p < 1$ and $q = 1 - p$

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Let's look at the formula in more detail...

If $X \sim Bin(n, p)$

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

Calculate the probability of x successes.

where $0 < p < 1$ and $q = 1 - p$

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Let's look at the formula in more detail...

If $X \sim Bin(n, p)$

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

Calculate the probability of n - x failures.

where $0 < p < 1$ and $q = 1 - p$

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Expectation and Variance

It can be shown that the for a binomial distribution with, n trials and a probability of success, p or in other words X ~ Bin(n, p) that...

$E(X) = np$

$Var(X) = npq$

This is given in the data booklet.

For Example:

If $X \sim Bin(20, 0.3)$

Then $E(X) =$ $Var(X) =$

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Calculating Probabilities

We have 3 ways to actually calculate the probabilities.

1) Using the formula.

2) Using the tables in the data booklet.

3) Using your calculator.

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Example

Suppose $X \sim Bin(7, 0.4)$

Calculate

$P(X = 4) = 0.1935$

$P(X = 6) = 0.0172$

$P(X \leq 5) = 0.9812$

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Continue to Practice using the Binomial Distribution

Ex 2.3A

Ex 2.3B

Aug 22-15:04

Plenary - 2017 Exam Question

A researcher is studying woodland rodents as hosts for parasite transmission. The study involves capturing, examining, marking and releasing rodents on a number of sites in the Loch Lomond basin in the West of Scotland. The theoretical chance of a recapture (capturing a rodent that has previously been marked and released), determined from previous studies, is 20%.

(a) At one site the researcher captures 20 individuals. What is the probability that exactly 3 are recaptures?

(2017)

Aug 28-09:48

Plenary - 2017 Exam Question

Question			Generic scheme	Illustrative scheme	Max mark
10	(a)		•[1] correct distribution	•[1] $X \sim B(20, 0{\cdot}2)$	2
			•[2] calculate probability	•[2] $P(X = 3) = 0.2053$	

(2017)

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