Lesson Resource: Critical regions (binomial distribution)

Teaching notes

This matching activity is designed to help students get a feel for one and two tailed tests and develop the idea of critical regions.

The 8 hypothesis cards and the 8 critical region cards should be cut up – they both have missing parts to them, which should be filled in.

The 2 sheets of graphs showing probabilities associated with values belonging to $X \sim B(20,0.4)$ are for reference and don't need to be cut up (or written on).

Note: The $P(0 \leq X \leq 4)$ = 0.0509 and this can been taken to be strictly > 0.05 so the 5% rejection values for p < 0.5 would be X = 0, 1, 2 or 3 , as X = 4 doesn't lie totally with in the rejection region in the lower tail of the distribution.
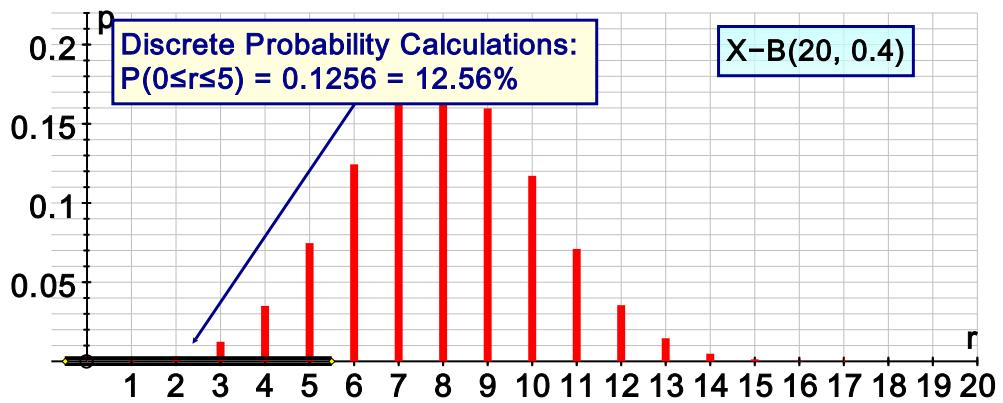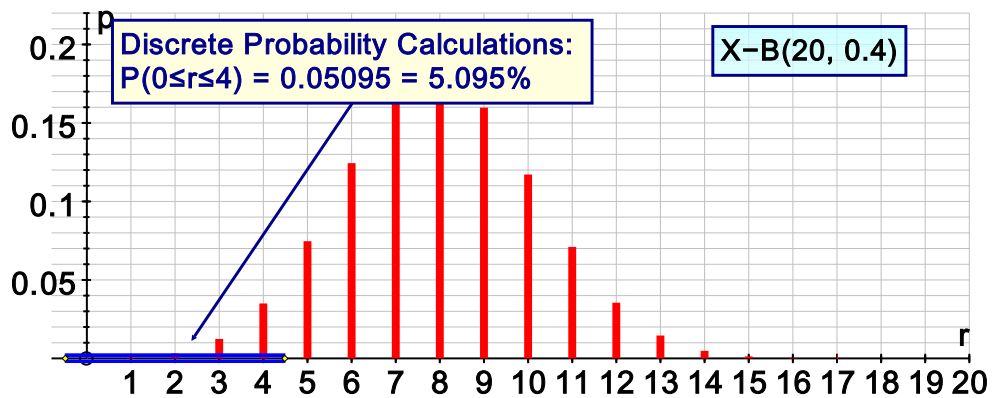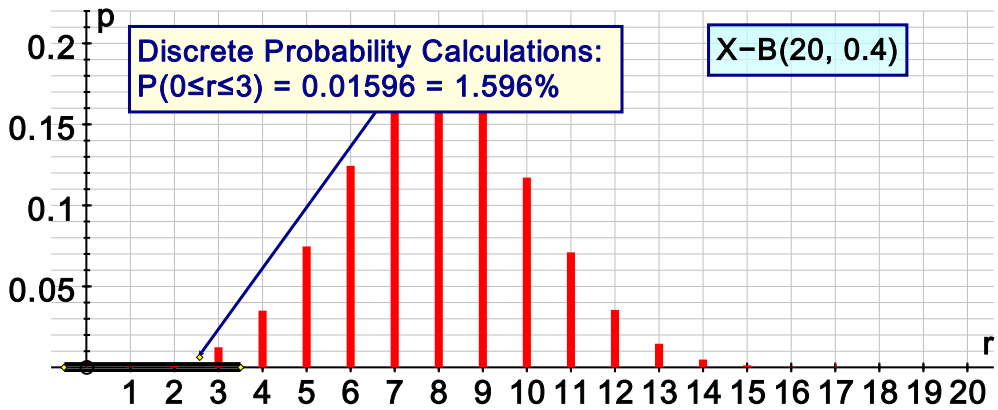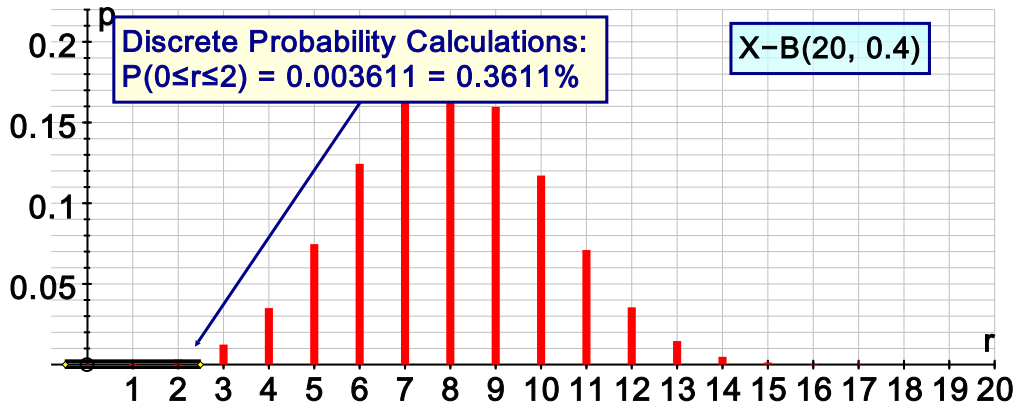
You may consider 0.0509 to be sufficiently close to 0.05 to call it 5% and make the rejection region $X \leq 4$

The cards have been designed to accommodate either practice.

$H_0: p = 0.4$ $H_1:$ ☐ If H_0 is true, $X \sim B(20, 0.4)$ Test at 1 % significance level	$H_0: p = 0.4$ $H_1: p < 0.4$ If H_0 is true, $X \sim B(20, 0.4)$ Test at 5 % significance level
$H_0: p = 0.4$ $H_1: p < 0.4$ If H_0 is true, $X \sim B(20, 0.4)$ Test at 2 % significance level	$H_0: p = 0.4$ $H_1:$ ☐ If H_0 is true, $X \sim B(20, 0.4)$ Test at 1 % significance level
$H_0: p = 0.4$ $H_1: p > 0.4$ If H_0 is true, $X \sim B(20, 0.4)$ Test at 5 % significance level	$H_0: p = 0.4$ $H_1: p > 0.4$ If H_0 is true, $X \sim B(20, 0.4)$ Test at 10 % significance level
$H_0: p = 0.4$ $H_1: p \neq 0.4$ If H_0 is true, $X \sim B(20, 0.4)$ Test at 5 % significance level	$H_0: p = 0.4$ $H_1: p \neq 0.4$ If H_0 is true, $X \sim B(20, 0.4)$ Test at 20 % significance level

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Critical region	**Critical region**
REJECT H_0 if $X \le 2$	REJECT H_0 if $X \le \boxed{}$
Critical region REJECT H_0 if $X > \boxed{}$	**Critical region** REJECT H_0 if $X \le \boxed{}$ or $X \ge \boxed{}$
Critical region REJECT H_0 if $X < 4$	**Critical region** REJECT H_0 if $X \ge \boxed{}$
Critical region REJECT H_0 if $X < 5$ or $X > 11$	**Critical region** REJECT H_0 if $X > 13$

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Bottom end of the X~B(20, 05) distribution

Discrete Probability Calculations:
P(0≤r≤2) = 0.003611 = 0.3611%

X~B(20, 0.4)

Discrete Probability Calculations:
P(0≤r≤3) = 0.01596 = 1.596%

X~B(20, 0.4)

Discrete Probability Calculations:
P(0≤r≤4) = 0.05095 = 5.095%

X~B(20, 0.4)

Discrete Probability Calculations:
P(0≤r≤5) = 0.1256 = 12.56%

X~B(20, 0.4)

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Top end of the X~B(20, 05) distribution

Discrete Probability Calculations:
P(14≤r≤20) = 0.006466 = 0.6466%

X~B(20, 0.4)

Discrete Probability Calculations:
P(13≤r≤20) = 0.02103 = 2.103%

X~B(20, 0.4)

Discrete Probability Calculations:
P(12≤r≤20) = 0.05653 = 5.653%

X~B(20, 0.4)

Discrete Probability Calculations:
P(11≤r≤20) = 0.1275 = 12.75%

X~B(20, 0.4)