

Stat 104 – Lecture 15

Binomial R. V.

- A special type of discrete random variable.
- Counts the number of “successes” in a series of independent trials.

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Example

- Draw three times, with replacement, from the bag o’ chips.
- Count the number of times you win bonus points (get a blue or red chip).

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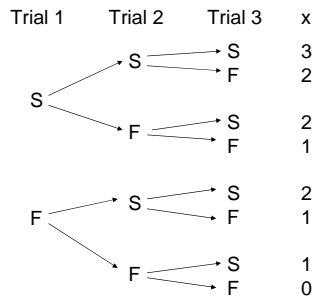
Example

- Number of independent trials
– $n = 3$
- Probability of success
– $p = 0.40$
- Count the number of successes
– $x = 0, 1, 2, \text{ or } 3$

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Tree Diagram



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Probability Distribution

- $P(3) = (0.4)*(0.4)*(0.4)$
 $= 0.064$
- $P(2) = (0.4)*(0.4)*(0.6) +$
 $(0.4)*(0.6)*(0.4) +$
 $(0.6)*(0.4)*(0.4)$
 $= 3(0.4)^2(0.6) = 0.288$

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Probability Distribution

- $P(1) = (0.4)*(0.6)*(0.6) +$
 $(0.6)*(0.4)*(0.6) +$
 $(0.6)*(0.6)*(0.4)$
 $= 3(0.4)(0.6)^2 = 0.432$
- $P(0) = (0.6)*(0.6)*(0.6)$
 $= 0.216$

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X = number of times bonus points
are won on three draws from
the bag o' chips.

x	0	1	2	3
P(x)	0.216	0.432	0.288	0.064

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Binomial R. V.

- General formula for the probability function.

$$P(x) = \binom{n}{x} p^x (1-p)^{n-x} \quad x = 0, 1, 2, \dots, n$$
$$\binom{n}{x} = \frac{n!}{x!(n-x)!}$$

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Example

- $n = 3, p = 0.4, x = 2$

$$P(2) = \binom{3}{2} (0.4)^2 (0.6)^{3-2}$$
$$= \frac{3 \cdot 2 \cdot 1}{(2 \cdot 1)(1)} (0.16)(0.6)$$
$$P(2) = 0.288$$

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Binomial R. V.

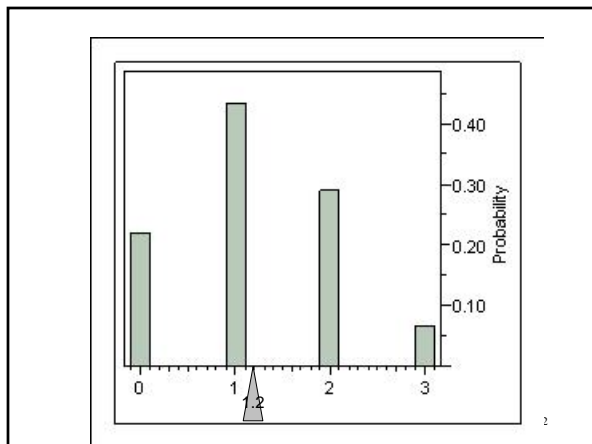
- Mean $\mu = np$
- Standard Deviation $\sigma = \sqrt{np(1-p)}$

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Example

- $n = 3, p = 0.40, (1 - p) = 0.60$
- Mean $\mu = np = 3(0.4) = 1.2$

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Example

- $n = 3, p = 0.40, (1 - p) = 0.60$
- Standard Deviation

$$\begin{aligned}\sigma &= \sqrt{np(1-p)} \\ &= \sqrt{3(0.4)(0.6)} \\ &= \sqrt{0.72} = 0.85\end{aligned}$$

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JMP

- Data Table
 - Column for x values
 - Column for P(x) values
- Cols – Formula ...
- Discrete Probability

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