Section 3.2: cont'd

Tuesday, June 02, 2015
2:30 PM

recall: for n trials with $P(\text{success}) = p$, then the probability of getting k successes is

$$P(x=k) = {}_nC_k \; p^k \; q^{n-k}$$

example: On Star Trek Voyager, the odds of crashing the shuttle on any away mission appear to be 75%. If these crashes are independent what are the odds of having exactly four crashes in five shuttle missions?

$n = 5$ $\quad$ $p = 0.75$ $\quad$ $q = 1 - p = 0.25$

$k = 4$

$$P(x=k) = {}_nC_k \; p^k \; q^{n-k}$$

$$P(x=4) = {}_5C_4 \; (0.75)^4 (0.25)^1$$

$$= 0.395508$$

$$= 40\%$$

what are the odds of having at least four crashes?

$$P(x \geq 4) = P(x=4) + P(x=5)$$

$$P(x=5) = {}_5C_5 \; (0.75)^5 (0.25)^0$$

then $P(x \geq 4) = 0.63 = 63\%$

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it turns out that for binomial distributions:

$$\mu = np$$

$$\sigma^2 = npq$$

$$\sigma = \sqrt{npq}$$

So, for the shuttle scenario, find the average number of shuttle crashes in five shuttle missions. Also, calculate the standard deviation.

$$\mu = np = 5(0.75) = 3.75$$

$$\sigma = \sqrt{npq} = \sqrt{5(0.75)(0.25)} = 0.9682$$
$$= 0.97$$

note: in fact, for 5 trials with $p = 0.75$

x	$p(x)$
0	0.000976
1	0.0146
2	0.087
3	0.2636
4	0.3955
5	0.2373

$\leftarrow \mu$

$\mu \pm 2\sigma$

$$\mu \pm 2\sigma = 1.8 \rightarrow 5.7$$