Section 5.2: cont'd

Tuesday, May 21, 2013
11:30 AM

| x | frequency | theoretical p(x) |
|---|---|---|
| 0 | I | 0.017 |
| 1 | II | 0.086 |
| 2 | 𝍸 I | 0.195 |
| 3 | 𝍸 𝍸 III | 0.260 |
| 4 | 𝍸 | 0.227 |
| 5 | II | 0.136 |
| 6 | I | 0.056 |
| 7 | II | 0.016 |
| 8 | | 0.003 |
| 9 | | 0.00033 |
| 10 | | 0.0000169 |

how do you calculate these? from last time:

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

$$p(x=k) = {}_{10}C_k \left(\frac{1}{3}\right)^k \left(\frac{2}{3}\right)^{10-k}$$

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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

a) exactly four crashes in five shuttle missions

b) at least four crashes in five shuttle missions

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

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

$$= 0.395508$$

$$= 0.40 \quad \text{or} \quad 40\%$$

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

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

$$= 0.3955 + 0.2373$$

$$= 0.63 = 63\%$$

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it turns out that for binomial distributions:

$\mu = np$ (mean)

$\sigma^2 = npq$ (variance)

$\sigma = \sqrt{npq}$ (std dev)

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

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

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

$= 0.9682$

$= 0.97$