Section 3.1 : cont'd

Thursday, May 28, 2015
10:31 AM

recall: $\mu = E(x) = \sum x\, p(x)$

variance:

$$\sigma^2 = E(x-\mu)^2$$

$$= \sum (x-\mu)^2 p(x)$$ ← formal definition (annoying to calculate)

$$= \sum x^2 p(x) - \mu^2$$ ← calculation formula (less annoying to calculate)

standard deviation: $\sigma = \sqrt{\sigma^2}$

example: consider the probability distribution given below. Calculate the mean and standard deviation of x.

x	$p(x)$
0	$1/10$
1	$6/10$
2	$3/10$

$$\mu = E(x) = \sum x\, p(x)$$

$$= 0 \cdot \frac{1}{10} + 1 \cdot \frac{6}{10} + 2 \cdot \frac{3}{10}$$

$$= 1.2$$

$$\sigma^2 = \sum x^2 p(x) - \mu^2$$

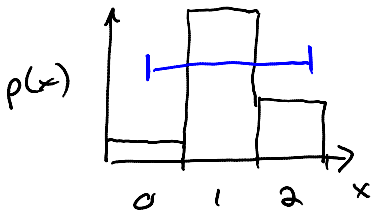
$$= 0^2 \cdot \frac{1}{10} + 1^2 \cdot \frac{6}{10} + 2^2 \cdot \frac{3}{10} - (1.2)^2$$

$= 0.36$

$\sigma = 0.6$

note: $\mu \pm 2\sigma = 1.2 \pm 2(0.6)$

$=$ from 0 to 2.4



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example: what is the expected value for winning the jackpot on BC Lotto 6/49 when the pot is 2.2 million dollars? Assume that there is only one winning ticket and it cost $2 to play.

how many tickets in total? ${}_{49}C_6 = 13\,983\,816$

odds of winning jackpot? $\frac{1}{13\,983\,816}$

X: either you lose $2

or you win $2.2 million (though you still have paid $2)

x	p(x)
-2	$1 - \frac{1}{13\,983\,816}$
$2.2\times10^6 - 2$	$\frac{1}{13\,983\,816}$

$$E(x) = \sum x\,p(x)$$

$$= -2\left(1 - \frac{1}{13983816}\right) + (2.2\times10^6 - 2)\frac{1}{13983816}$$

$$= -2 + \frac{2.2\times10^6}{13983816}$$

$$= -1.84$$

On average, you lose \$1.84 each time you play.

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discrete random variables are used for a variety of everyday situations

→ there are some very common scenarios that have named distributions associated with them

we will look at two of them:

- binomial
- Poisson