Section 3: Discrete Random Variables

Monday, March 20, 2017 1:17 PM

definition: a discrete random variable is a variable that can only take on certain values

example: consider the number of heads observed in 3 fair coin tosses

let x = the number of heads observed

x	outcomes	# outcomes	p(x)
0	TTT	1	1/8
1	HTT THT TTH	3	3/8
2	HHT HTH THH	3	3/8
3	HHH	1	1/8
		8	

definition: the probability distribution of a discrete random variable is a table (or formula or graph) listing the probability for each possible value of the random variable x

so for our previous example, the probability distribution is

x	$p(x)$
0	1/8
1	3/8
2	3/8
3	1/8

so, how can we find the mean? the std dev?

the mean is

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

this is also called the expected value $E(x)$

the variance

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

the std dev

$$\sigma = \sqrt{\sigma^2}$$

handout question 1 section 3

x	$P(x)$
-5	0.15
-2	0.2
1	0.4
6	0.25

a) $P(-2.5 < x < 2.5)$ $= P(-2) + P(1)$

$= 0.2 + 0.4$

$= 0.6$

b) the mean of x:

$$\mu = \sum x\, p(x)$$
$$= (-5)(0.15) + (-2)(0.2) + 1(0.4) + 6(0.25)$$
$$= 0.75$$

c) the variance of x:

$$\sigma^2 = \sum x^2 p(x) - \mu^2$$
$$= (-5)^2(0.15) + (-2)^2(0.2) + (1)^2(0.4) + 6^2(0.25) - (0.75)^2$$
$$= 13.3875$$

d) the std dev:

$$\sigma = \sqrt{\sigma^2} = \sqrt{13.3875} \approx 3.66$$

e) the probability than an x-value lies

within one standard deviation of the mean

$$P(\mu - \sigma \leq x \leq \mu + \sigma) = P(-2.91 \leq x \leq 4.41)$$

one std dev below mean

$$= P(-2) + P(1)$$

$$= 0.2 + 0.4$$

$$= 0.6$$