Chapter 5
Discrete Probability Distributions

Learning Objectives

1. Understand the concepts of a random variable and be able to distinguish between discrete and continuous random variables.

2. Be able to compute and interpret the expected value, variance, and standard deviation for a discrete random variable.

3. Be able to compute and work with probabilities involving a binomial probability distribution.

Solutions:

2. a. Let x = time (in minutes) to assemble the product.

   b. It may assume any positive value: $x > 0$.

   c. Continuous

3. Let Y = position is offered
   N = position is not offered

   a. S = {(Y,Y,Y), (Y,Y,N), (Y,N,Y), (Y,N,N), (N,Y,Y), (N,Y,N), (N,N,Y), (N,N,N)}

   b. Let N = number of offers made; N is a discrete random variable.

   c.

Experimental Outcome	(Y,Y,Y)	(Y,Y,N)	(Y,N,Y)	(Y,N,N)	(N,Y,Y)	(N,Y,N)	(N,N,Y)	(N,N,N)
Value of N	3	2	2	1	2	1	1	0

13. a. Yes, since $f(x) \geq 0$ for $x = 1,2,3$ and $\Sigma f(x) = f(1) + f(2) + f(3) = 1/6 + 2/6 + 3/6 = 1$

   b. $f(2) = 2/6 = .333$

c. $f(2) + f(3) = 2/6 + 3/6 = .833$

14. a. $f(200) = 1 - f(-100) - f(0) - f(50) - f(100) - f(150)$

$= 1 - .95 = .05$

This is the probability MRA will have a $200,000 profit.

b. $P(\text{Profit}) = f(50) + f(100) + f(150) + f(200)$

$= .30 + .25 + .10 + .05 = .70$

c. $P(\text{at least } 100) = f(100) + f(150) + f(200)$

$= .25 + .10 + .05 = .40$

15. a.

x	$f(x)$	$x f(x)$
3	.25	.75
6	.50	3.00
9	.25	2.25
	1.00	6.00

$E(x) = \mu = 6$

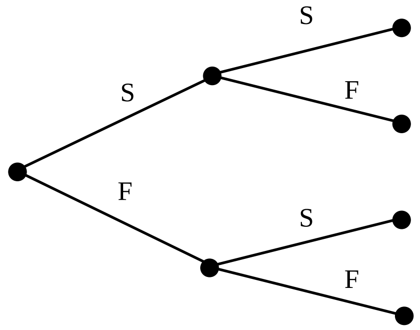
b.

x	$x - \mu$	$(x - \mu)^2$	$f(x)$	$(x - \mu)^2 f(x)$
3	-3	9	.25	2.25
6	0	0	.50	0.00
9	3	9	.25	2.25
				4.50

$\text{Var}(x) = \sigma^2 = 4.5$

c. $\sigma = \sqrt{4.50} = 2.12$

25. a.



b. $f(1) = \binom{2}{1}(.4)^1(.6)^1 = \frac{2!}{1!1!}(.4)(.6) = .48$

c. $f(0) = \binom{2}{0}(.4)^0(.6)^2 = \frac{2!}{0!2!}(1)(.36) = .36$

d. $f(2) = \binom{2}{2}(.4)^2(.6)^0 = \frac{2!}{2!0!}(.16)(1) = .16$

e. $P(x \geq 1) = f(1) + f(2) = .48 + .16 = .64$

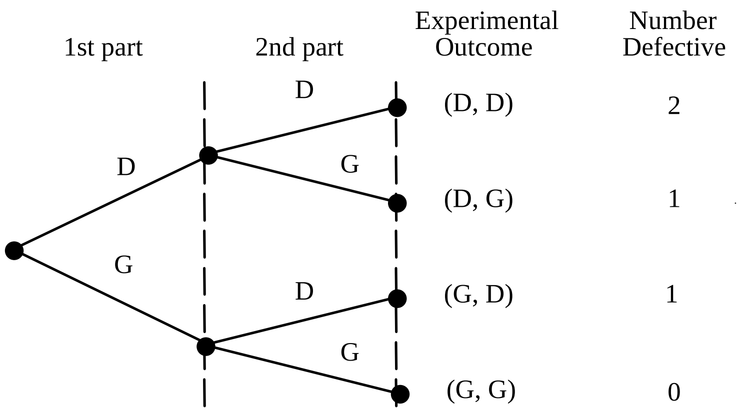
f. $E(x) = n\,p = 2\,(.4) = .8$

$\text{Var}(x) = n\,p\,(1 - p) = 2\,(.4)\,(.6) = .48$

$\sigma = \sqrt{.48} = .6928$

30. a. Probability of a defective part being produced must be .03 for each part selected; parts must be selected independently.

b. Let: D = defective
G = not defective



c. 2 outcomes result in exactly one defect.

d. $P(\text{no defects}) = (.97)\,(.97) = .9409$

$P\,(1 \text{ defect}) = 2\,(.03)\,(.97) = .0582$

$P\,(2 \text{ defects}) = (.03)\,(.03) = .0009$