1552 - §5-4 WS

MATH 1610/MATH 1552
5.4 Worksheet

Example 1 At a department store, the store manager estimates that there is a 40% probability that any one of the next nine customers will make a purchase.
What is the probability that four of the next nine customers will make a purchase?

a. Determine the values of n, x, p, and 1-p. Use the binomial probability formula to determine the probability that four of the nine customers will make a purchase.

$n = 9$
$x = 4$
$p = 0.40$
$1 - p = 0.60$

$$f(4) = \binom{9}{4}(0.40)^4(0.60)^{9-4}$$
$$= \frac{9!}{4!\,5!}(0.40)^4(0.60)^5$$
$$= 0.2508$$

b. Use the table to verify the probability that four of the nine customers will make a purchase.

	x	p = 0.01	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	
n=9	0	0.9135	0.6302	0.3874	0.2316	0.1342	0.0751	0.0404	0.0207	0.0101	0.0046	0.0020	9
	1	0.0830	0.2985	0.3874	0.3679	0.3020	0.2253	0.1556	0.1004	0.0605	0.0339	0.0176	8
	2	0.0034	0.0629	0.1722	0.2597	0.3020	0.3003	0.2668	0.2162	0.1612	0.1110	0.0703	7
	3	0.0001	0.0077	0.0446	0.1069	0.1762	0.2336	0.2668	0.2716	0.2508	0.2119	0.1641	6
→	4		0.0006	0.0074	0.0283	0.0661	0.1168	0.1715	0.2194	0.2508	0.2600	0.2461	5
	5			0.0008	0.0050	0.0165	0.0389	0.0735	0.1181	0.1672	0.2128	0.2461	4
	6			0.0001	0.0006	0.0028	0.0087	0.0210	0.0424	0.0743	0.1160	0.1641	3
	7					0.0003	0.0012	0.0039	0.0098	0.0212	0.0407	0.0703	2
	8						0.0001	0.0004	0.0013	0.0035	0.0083	0.0176	1
	9								0.0001	0.0003	0.0008	0.0020	0

c. Use the binomial table to determine the probability that **at least seven** of the nine customers will make a purchase.

$$P(\text{at least 7 purchase}) = P(x=7) + P(x=8) + P(x=9)$$
$$= 0.0212 + 0.0035 + 0.0003$$
$$= 0.025$$

$$\binom{9}{7}(0.4)^7(0.6)^2 + \binom{9}{8}(0.4)^8(0.6)^1 + \binom{9}{9}(0.4)^9(0.6)^0$$
$$0.0212 + 0.0035 + 0.00026$$

Example 2 Suppose a salesperson visits 10 randomly selected families. From prior experience, the salesperson knows that there is a 25% chance that a randomly selected family will purchase an insurance policy. What is the probability that six families purchase an insurance policy?

Random Variable: let x = the family purchases an insurance policy

a. Determine the values of n, x, p, and 1-p. Use the binomial probability formula to determine the probability that six of the ten customers will make a purchase.

$n = 10$

$x = 6$

$p = 0.25$

$1-p = 0.75$

$P(6 \text{ families purchase}) = \binom{10}{6}(0.25)^6(0.75)^{10-6}$

$= \underbrace{\frac{10!}{6!\,4!}}_{210}(0.25)^6(0.75)^4$

$= 0.0162$

b. Use the table to verify the probability that six of the ten customers will make a purchase.

	x	0.01	0.05	0.10	0.15	0.20	p = 0.25	0.30	0.35	0.40	0.45	0.50	
n=10	0	0.9044	0.5987	0.3487	0.1969	0.1074	0.0563	0.0282	0.0135	0.0060	0.0025	0.0010	10
	1	0.0914	0.3151	0.3874	0.3474	0.2684	0.1877	0.1211	0.0725	0.0403	0.0207	0.0098	9
	2	0.0042	0.0746	0.1937	0.2759	0.3020	0.2816	0.2335	0.1757	0.1209	0.0763	0.0439	8
	3	0.0001	0.0105	0.0574	0.1298	0.2013	0.2503	0.2668	0.2522	0.2150	0.1665	0.1172	7
	4		0.0010	0.0112	0.0401	0.0881	0.1460	0.2001	0.2377	0.2508	0.2384	0.2051	6
	5		0.0001	0.0015	0.0085	0.0264	0.0584	0.1029	0.1536	0.2007	0.2340	0.2461	5
→	6			0.0001	0.0012	0.0055	0.0162	0.0368	0.0689	0.1115	0.1596	0.2051	4
	7				0.0001	0.0008	0.0031	0.0090	0.0212	0.0425	0.0746	0.1172	3
	8					0.0001	0.0004	0.0014	0.0043	0.0106	0.0229	0.0439	2
	9							0.0001	0.0005	0.0016	0.0042	0.0098	1
	10									0.0001	0.0003	0.0010	0

c. Use the binomial table to determine the probability that two or four or eight families will purchase an insurance policy.

$P(2 \text{ or } 4 \text{ or } 8 \text{ families buy}) = P(x=2) + P(x=4) + P(x=8)$

$= 0.2816 + 0.1460 + 0.0004$

$= 0.428$