Review Test Ch. 7 + 8

p. 506

(55) $P(X \geq 26) = \boxed{0.99058}$

$\mu_X = (-99,750)(.00183) + (-99,500)(.00186) + (-99,250)(.00189)$
$+ (-99,000)(.00191) + (-98,750)(.00193) + (1250)(.99058)$
$= \boxed{\$303.35}$ In the long run, we can expect the mean earnings to be \$303.35.

(56) The insurance company relies on the law of large numbers. Even though the company will lose a large amount of money on a small number of policy holders who die (at a young age), it will gain a small amount (\$1250) from many 21-year old men (who live beyond 26 yrs old). In the long run, the insurance company expects to make \$303.35 per insurance policy.

(57) $\sigma_X^2 = (-99,750 - 303.35)^2(.00183) + (303.35 - 99,500)^2(.00186)$
$+ (303.35 - 99,250)^2(.00189) + (303.35 - 99,000)^2(.00191)$
$+ (303.35 - 98,750)^2(.00193) + (303.35 - 1250)^2(.99058) = \$94,226,826.64$

$\sigma_X = \sqrt{94,226,826.64} = \$9,707.57$

58 a) $Z = \frac{X+Y}{2} = .5X + .5Y$

$\mu_x = \$303.35 \qquad \mu_y = \$303.35$

$\mu_z = \mu_{.5x+.5y} = .5(\mu_x) + .5(\mu_y) = .5(303.35) + .5(303.35)$

$\mu_z = \boxed{\$303.35}$

$\sigma_z = \sigma_{.5+.5y} = \sqrt{\sigma^2_{.5x} + \sigma^2_{.5y}} = \sqrt{(.5)^2(\sigma_x^2) + (.5)^2(\sigma_y^2)}$

$= \sqrt{(.5)^2(94{,}236{,}826.64) + (.5)^2(94{,}236{,}826.64)}$

$= \sqrt{47{,}118{,}413.32} = \boxed{\$6864.29}$

b) $\mu_z = \mu_{\frac{1}{4}(x_1+x_2+x_3+x_4)} = \mu_{\frac{1}{4}x_1 + \frac{1}{4}x_2 + \frac{1}{4}x_3 + \frac{1}{4}x_4}$

$= \frac{1}{4}(\mu_{x_1}) + \frac{1}{4}(\mu_{x_2}) + \frac{1}{4}(\mu_{x_3}) + \frac{1}{4}(\mu_{x_4})$

$= 1(303.35) = \boxed{\$303.35}$

$\sigma_{\frac{1}{4}(x_1+x_2+x_3+x_4)} = \sqrt{\left(\frac{1}{4}\right)^2(9707.57) + \left(\frac{1}{4}\right)^2(9707.57) + \left(\frac{1}{4}\right)^2(9707.57) + \left(\frac{1}{4}\right)^2(9707.57)} = \sqrt{23659.2066}$

$= \boxed{\$4863.78}$

p. 556

59 a) Opinions of husband and wife are <u>not</u> <u>independent</u>. (Spouses tend to share the same opinion.) <u>Not</u> <u>Binomial</u>

b) Opinions of fraternity brothers not independent.

<u>Not</u> <u>Binomial</u>

60 X = number of households out of 12 who own 3 or more motor vehicles.

$B(12, 0.2)$ *all conditions met for binomial

$n = 12 \quad p = 0.2 \quad q = 0.8$

a) $P(X=0) = {}_{12}C_0 (.2)^0 (.8)^{12} = 0.0687$

The probability that none of the 12 households own 3 or more vehicles is 6.87%.

$P(X \geq 1) = 1 - P(X=0) = 1 - .0687 = .9313$

The probability that at least 1 household out of the 12 owns 3 or more motor vehicles is 93.13%.

b) $\mu_x = np = (12)(.2) = 2.4$ households

$\sigma_x = \sqrt{npq} = (12)(.2)(.8) = 1.3856$ households

c) $P(X > 2.4) = 1 - P(x \leq 2) = 1 - [{}_{12}C_0 (.2)^0 (.8)^{12} + {}_{12}C_1 (.2)^1 (.8)^{11} + {}_{12}C_2 (.2)^2 (.8)^{10}]$

$= 1 - .5583 = .4417$

The probability that more than 2.4 households out of 12 will own 3 or more vehicles is 44.17%

(63) X = number of Southerners out of 20 who believe in God and Prayer

$B(20, .46)$ ★ meets prop of Binomial Dist.

$n = 20$ $p = .46$ $q = .54$ ★ 28% is for OTHER STATES !!

a) $P(X=10) = {}_{20}C_{10}(.46)^{10}(.54)^{10} = 0.1652$

The probability that exactly 10 out of 20 Southerners believe in God and prayer is 16.52%.

b) $P(10 \le x \le 15) = {}_{20}C_{10}(.46)^{10}(.54)^{10} + {}_{20}C_{11}(.46)^{11}(.54)^{9} + \ldots + {}_{20}C_{15}(.46)^{15}(.54)^{5}$

$\downarrow P(X \le 10) - P(X \le 14)$

$= .4423$

★ $P(10 < X < 15) = P(X \le 14) - P(X \le 10) = .2708$

(Not including 10 and 15)

To use binomcdf : binomialcdf(20, .44, 15) − bincdf(20, .44, 9)

subtract probs to get area between values

Sentence ... Here

c) $P(X > 15) = 1 - P(X \le 15) = 1 - [{}_{20}C_{15}(.46)^{15}(.54)^{5} + \ldots + {}_{20}C_{0}(.46)^{0}(.54)^{20}]$

$= 1 - .9980 = .002$

Sentence ... Here

(d) $P(X<8) = P(X \le 7) = {}_{12}C_7(.2)^7(.8)^5 + \ldots + {}_{12}C_0(.2)^0(.8)^{12}$

$= 0.2241$

Sentence Here

(64) X = number of schools that have a soft drink contract

$B(20, .62)$ $n=20$ $p=.62$ $q=.38$

a) $P(X=8) = {}_{20}C_8(.62)^8(.38)^{12} = 0.0249$

Sentence Here

b) $P(X \le 8) = {}_{20}C_0(.62)^0(.38)^{20} + \ldots + {}_{20}C_8(.62)^8(.38)^{12} = .0381$

Sentence Here

c) $P(X \ge 4) = 1 - P(X \le 3) = 1 - [{}_{20}C_0(.62)^0(.38)^{20} + {}_{20}C_1(.62)^1(.38)^{19} + \ldots {}_{20}C_3(.62)^3(.38)^{17}]$

$= 1 - .00002$
$= 0.99998$

Sentence Here

d) $P(4 \le X < 12) = P(X \le 12) - P(X \le 3) =$

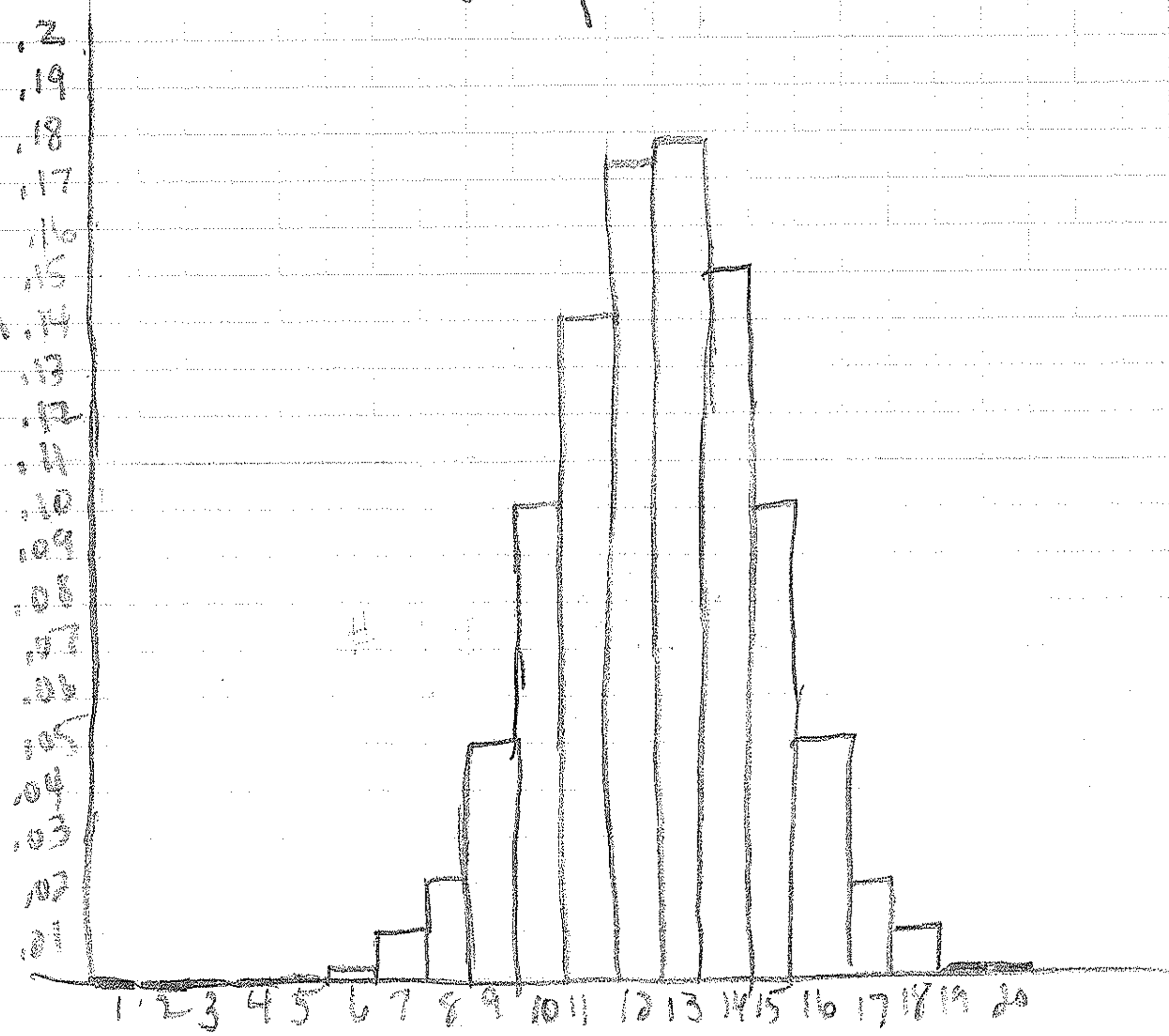
show formula work

$= .5108 - .00002 = .51076$

e) X = number of schools out of 20 that have a soft drink contract

X	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
P(x)	0	0	0	0	0	0	.0029	.0094	.0249	.0548	.0994	.1444	.1767	.1774	.1447	.0945	.0482	.0185	.0058	0	0

Schools with Soft drink Contracts



# of schools

(65) X = number of positive tests out of 1000

a) $B(1000, .004)$

b) $\mu_X = np = (1000)(.004) = 4$ positive tests

c) $np \overset{?}{\geq} 10$

$1000(.004) \geq 10$

$4 \not\geq 10$ Does not satisfy condition

(66) X = the number of customers out of 10 who purchase strawberry frozen yogurt.

$B(10, 0.2)$ $n = 10$ $p = .2$ $q = .8$

$$P(X \geq 5) = 1 - P(X \leq 4) = 1 - \left[{}_{10}C_4 (.2)^4 (.8)^6 + {}_{10}C_3 (.2)^3 (.8)^7 + \dots + {}_{10}C_0 (.2)^0 (.8)^{10}\right]$$

$= 1 - .9672$

$= .0328$

The probability of at least 5 out of 10 customers purchasing strawberry frozen yogurt is 3.28%. Even though this is a small probability (rare occurance), this event does occur.