Chapter 4 Key

1 the Random variable (RV) is not Binomial b/c p changes from draw to draw

2 Yes Binomial $n = 2$ $p = 3/5$

x is Binomial

6 a) $p(x \le 3) = .995$ b) $n=12$ $p=.6$ $P(x \le 7) = .562$ c) $n=25$ $n=1/2$ $p(x \le 14) = .788$

13 $n=100$ x = Binomial a) $\mu = 100(.01) = 1$ $\sigma = \sqrt{100(.01)(.99)} = .99$

b) $\mu = 100(.9) = 90$ $\sigma = \sqrt{100(.9)(.1)} = 3$ c) $\mu = 100(.3) = 30$ $\sigma = \sqrt{100(.3)(.7)} = 4.58$

d) $\mu = 100(.7) = 7$ $\sigma = \sqrt{100(.7)(.3)} = 4.58$ e) $\mu = 100(.5) = 50$ $\sigma = \sqrt{100(.5)(.5)} = 5$

15 not a binomial because out come has 4 choices not 2

16 Binomial yes (if independent) $n = 5000$ x = # of HMO members that are satisfied (

19 Binomial $n = 5$ x = # of applicants that falsify info $p = .35$

$P(x \ge 1) = 1 - P(x=0) = 1 - \binom{5}{0}(.35)^0(.65)^5 = 1 - .116 = .884$

$P(x \ge 2) = 1 - P(x=0) - P(x=1) = 1 - .116 - \binom{5}{1}(.35)^1(.65)^4 = .572$

.312

23 Binomial if x = # costumers ordering hot dog $n = 600$ $p = (.033)$

$\mu = 600(.033) = 19.8$ $\sigma^2 = \sqrt{600(.033)(.967)} = 4.376$

- don't use empirical rule b/c p is close to 0 so not bell shaped

$19.8 \pm 3(4.376) = \{6.672 \text{ to } 32.928\}$ at least .89 will fall in this interval

$\mu = 1.2$

24 a) $P(x=0) = \frac{1.2^0 e^{-1.2}}{0!} = .301194$ b) $P(x=1) = \frac{1.2^1 e^{-1.2}}{1!} = .36143$

c) $P(x \le 2) = P(x=0) + P(x=1) + P(x=2) = .301194 + .36143 + \frac{1.2^2 e^{-1.2}}{2!} = .8794$

d) $P(x > 1) = 1 - P(x=0) - P(x=1) = 1 - .30194 - .36143 = .33737$

28 a) $P(x \le 2)\ \mu = 3 = .423$

b) $P(x \ge 1)\ \mu = 1 = 1 - P(x=0) = 1 - .368 = .632$

c) $P(x=2)\ \mu = 2 = .677 - .406 = .271$

30 x = # time visit- in a half hour $\mu = 1$

$P(x=0) = \frac{1^0 e^{-1}}{0!} = .367879$

$P(x=1) = \frac{1^1 e^{-1}}{1!} = .367879$ $P(x=2) = \frac{1^2 e^{-1}}{2!} = .18394$

$P(x \ge 1) = 1 - P(x=0) = .632121$

34 x = # people entering ICU in a day $\mu = 5$

a) $P(x=2) = .125 - .04 = .085$ and $P(x \le 2) = .125$ - read from table

b) $P(x \ge 16) = 1 - P(x \le 10) = 1 - .986 = .014$ so it is unlikely

38 Hyper/no replacement $N = 20$ $n = 10$ $r = 5$ x = # best engeneers

$$P(x=5) = \frac{\binom{5}{5}\binom{15}{5}}{\binom{20}{10}} = \frac{\frac{5!}{5!(0!)}\frac{15!}{5!(10)!}}{\frac{20!}{10!(10!)}} = 1\left(\frac{15!}{5!\cancel{10!}}\right)\left(\frac{\cancel{10!}\,10!}{20!}\right)$$

$$= \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6}{20 \cdot 19 \cdot 18 \cdot 17 \cdot 16} = .01625$$

40 $N=10 \quad n=4 \quad r=3 \quad x=$ # of companies restructuring

$P(x=3)$ a) $\dfrac{\binom{3}{3}\binom{7}{1}}{\binom{10}{4}} = \dfrac{1\left(\frac{7!}{1!(6!)}\right)}{\frac{10!}{4!(6!)}} = \dfrac{7!\,4!}{10!} = \dfrac{4\,3\,2}{10\,9\,8} = .0333$

$P(x=0)$ b) $\dfrac{\binom{3}{0}\binom{7}{4}}{\binom{10}{4}} = \dfrac{1\,\frac{7!}{4!(3!)}}{\frac{10!}{4!(6!)}} = \dfrac{7!\,6!}{10!\,3!} = \dfrac{6\cdot5\cdot4}{10\cdot9\cdot8} = .166$

c) $P(x \geq 1) = 1 - P(x=0) = 1 - .166 = .834$

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48 $n=5 \quad p=1/2$ $x=$ # of times late last 5 days — 2 options: Late (over 35 min) not late (<35) m

so Binomial

$P(x=5) = \binom{5}{5}(.5)^5(.5)^0 = .03125$

$P(x \geq 3) = P(x=4) + P(x=5) = \binom{5}{4}(.5)^4(.5)^1 + .03125 = .1875$

$\frac{5}{4!(1!)}\,5\,(.0625)(.5)$

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51 $n=10 \quad p=3/10$ 2 options: business call / personal call — independent so Binomial $x=$ # personal calls

a) $P(x \leq 1) = .149$ from table

b) $P(x > 5) = 1 - P(x \leq 5) = 1 - .953 = .047$ from table

c) $P(x=3) = .650 - .383 = .267$ from table

Binomal $x=$ # personal calls $n = 10$ million $p = 1/3$

52 a) $E(x) = n(p) = 10{,}000{,}000(1/3) = 3{,}333{,}333$

b) $\sigma = \sqrt{10{,}000{,}000(1/3)(2/3)} = 1490.71$

c) z-score $\dfrac{3{,}300{,}000 - 3{,}333{,}333}{1490.71} = -22.36$ s.d. below the mean

it is highly unlikely this will happen

5.4 a) $N=15 \quad n=5 \quad r=8 \quad x=$ # owners that have Honda made in USA

$$P(x=5) = \frac{\binom{8}{5}\binom{7}{0}}{\binom{15}{5}} = \frac{\frac{8!}{5!(3!)}(1)}{\frac{15!}{5!(10!)}} = \frac{8!\,10!}{15!\,3!} = \frac{8\,7\,6\,5\,4}{15\,14\,13\,12\,11} = .0186$$

64 $\mu = 3.5 \quad x =$ # fatal accedents

a) $P(x \geq 11) = 1 - P(x \leq 11) = 1 - .999 = .001$ (from table)

b) $\mu = 3.5 \quad \sigma = \sqrt{3.5} = 1.87$

z-score $\frac{11-3.5}{1.87} = 4.01$ s.t. a way from mean very unlikely may be the # of accedents are increasing

65 $n = 600 \quad x =$ # of Americans who think preventing nuculan spread

$p = .70$ Choise – prevention #1
prevention not #1

a) $\mu = 600(.7) = 420$

$\sigma = \sqrt{600(.7)(.3)} = 11.225$

b) $z = \frac{365-420}{11.225} = -4.90$ unlikely

c) 70% may not be correct