Math 153 - Quiz 7

April 2, 2015

Name key

Score _____

Show all work to receive full credit. Supply explanations when necessary.

EXTRA CREDIT ON BACK.

1. (5 points) In the United States, Asian Americans contract tuberculosis (TB) at an average rate of 18.7 cases per 100,000 persons per year.

   (a) In any given year, what is the probability that the contraction rate is 20 or more per 100,000 persons?

POISSON WITH $\mu = 18.7$

$$P(x \geq 20) = 1 - P(x < 20)$$
$$= 1 - P(x \leq 19) = 1 - \text{poissoncdf}(18.7, 19)$$
$$\approx \boxed{0.4121}$$

   (b) What would be an unusually large contraction rate?

$$\mu + 2\sqrt{\mu} = 18.7 + 2\sqrt{18.7}$$
$$\approx \boxed{27.35}$$

2. (5 points) A company that monitors Internet messages has found that 91% of all email messages are spam. Suppose you select a random sample of 25 of your email messages.

   (a) What is the probability that exactly 22 are spam?

BINOMIAL $N = 25$, $p = 0.91$, $q = 0.09$

$$P(x = 22) = \text{binompdf}(25, 0.91, 22)$$
$$\approx \boxed{0.2106}$$

   (b) What is the probability that at least 22 are spam?

$$P(x \geq 22) = 1 - P(x < 22) = 1 - P(x \leq 21)$$
$$= 1 - \text{binomcdf}(25, 0.91, 21)$$
$$\approx \boxed{0.8169}$$

   (c) What is an unusually small number of spam messages?

$$\mu - 2\sigma = (25)(0.91) - 2\sqrt{(25)(0.91)(0.09)}$$
$$\approx 19.89$$
$$\Rightarrow \boxed{19 \text{ OR FEWER}}$$

#1 IS APPROXIMATELY BINOMIAL WITH

$$N = 100{,}000$$

$$p = \frac{18.7}{100{,}000}$$

$$q = \frac{99{,}981.3}{100{,}000}$$

a) $1 - \text{binomcdf}\left(100000, \frac{18.7}{100000}, 19\right)$

$$\approx \boxed{0.4121}$$

b) $\mu + 2\sigma = Np + 2\sqrt{Npq}$

$$\approx 18.7 + 2\sqrt{18.69650\ldots}$$

$$\approx \boxed{27.35}$$