## AP Statistics – Chapter 7 Test Version A

Name________________________________

**Part 1 (3 pts each – Total 21 pts): MULTIPLE CHOICE. Choose the one alternative that best answers the question.**

1) Which of these random variables has a geometric model?
   - A) The number of cars inspected until we find three with bad mufflers.
   - B) The number of Democrats among a group of 20 randomly chosen adults.
   - C) The number of people we check until we find someone with green eyes.
   - D) The number of cards of each suit in a 10-card hand.
   - E) The number of aces among the top 10 cards in a well-shuffled deck.

2) Which of these random variables is most likely to have a binomial model?
   - A) The number of Democrats among a group of 20 randomly chosen adults.
   - B) The number of cards of each suit in a 10-card hand.
   - C) The number of aces among the top 10 cards in a well-shuffled deck.
   - D) The number of people we check until we find someone with green eyes.
   - E) The number of cars inspected until we find three with bad mufflers.

3) Pepsi is running a sales promotion in which 12% of all bottles have a "FREE" logo under the cap. What is the probability that you find two free ones in a 6-pack?

   A) 11% B) 13% C) 97% D) 23% E) 1%

4) A national study found that the average family spent $422 a month on groceries, with a standard deviation of $84. The average amount spent on housing (rent or mortgage) was $1120 a month, with standard deviation $212. The expected total a family spends on food and housing is 422 + 1120 = $1542. What is the standard deviation of the total? Tip: read carefully to determine correct method and conditions.
   - A) $128
   - B) $295
   - C) $228
   - D) $148
   - E) It cannot be determined.

5) A supermarket claims that their checkout scanners correctly price 99.8% of the items sold. How many items would you expect to buy, on average, to find one that scans incorrectly?

   A) 500 B) 998 C) 99.8 D) 2 E) 200

6) Some marathons allow two runners to "split" the marathon by each running a half marathon. Alice and Sharon plan to split a marathon. Alice's half-marathon times average 92 minutes with a standard deviation of 4 minutes, and Sharon's half-marathon times average 96 minutes with a standard deviation of 2 minutes. Assume that the women's half-marathon times are independent. The expected time for Alice and Sharon to complete a full marathon is 92 + 96 = 188 minutes. What is the standard deviation of their total time?
   - A) 4.5 minutes
   - B) It cannot be determined.
   - C) 20 minutes
   - D) 6 minutes
   - E) 2 minutes

## AP Statistics – Chapter 7A Test

**Part 2 (4 pts each sub question). SHORT ANSWER. Clearly show your work. Always check conditions have been met, identify the distribution model (including its parameters), using the correct statistical notation when giving answers (do not simply give a number); and when asked write answer c learly in context.**

1) **Height of adults** According to the National Health Survey, heights of adults may have a Normal model with mean heights of 69.1" for men and 64.0" for women. The respective standard deviations are 2.8" and 2.5."

$\mu_M = 69.1"$ $\sigma_M = 2.8$ IN

$\mu_W = 64.0$ $\sigma_W = 2.5$ IN

a. Based on this information,

i. How much taller are men than women, on average?

$E(m-w) = 69.1 - 64 = 5.1$ IN

ii. What is the standard deviation for the difference in men's and women's heights?

$VAR(m-w) = 2.8^2 + 2.5^2 = 14.09$

$\sigma_{m-w} = 3.75$ IN

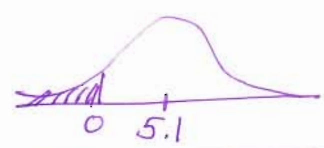
b. Assume that women date men without considering the height of the man (i.e., that the heights of the couple are independent). What is the probability that a woman dates a man shorter than she is?

LET $D = m - w$ $N(5.1, 3.75)$

$P(m-w < 0) = P(D<0) =$

normalcdf$(-1E99, 0, 5.1, 3.75) =$

$.0869$




THERE IS ABOUT AN 8% CHANCE A WOMEN DATES A SHORTER MAN

2) **Strange dice** A game is played with 2 strange dice.
- The six faces of Die A show a 1 and five 3's.
- Die B has four 2's and two 6's.

Dice 1

| | | |
|---|---|---|
| 1 | 2 | 2 6 |
| 1 | 2 | 2 6 |
| 3 | 2 | 2 6 |
| 3 | 2 | 2 6 |

← Dice 2

1, 2 = 3
1, 6 = 7
3, 2 = 5
3, 6 = 9

a. Create a probability model for the total you get when you roll both dice.

| X (Total) | 3 | 5 | 7 | 9 | |
|---|---|---|---|---|---|
| P(x) | 4/36 | 20/36 | 2/36 | 10/36 | 36/36 |
| | .11 | .55 | .06 | .28 | 1.00 |

b. Find the mean of the total. Use the appropriate notation when stating your answer.

$E(x) = \mu_x = 6$ or $6.02$

c. Find the standard deviation of the total. Use the appropriate notation when stating your answer.

$\sigma_x^2 = 4.1196$

$\boxed{\sigma_x = 2 \text{ OR } 2.0296}$

3) **Smoking** State public health officials claim that 18% of adults currently smoke cigarettes. We start selecting a few adults at random, asking each if he or she is a smoker.

a. Explain why these can be considered Bernoulli trials( either binomial, geometric, ~~or normal~~) Explain and the state 4 conditions to support your decision.

B 2 OUTCOMES (SMOKE, NOT)

I INDEPENDENT – RANDOMLY SELECTED

N TRIALS UNTIL FIRST SMOKER

S FIXED PROBABILITY $p = .18$

b. Let X represent the number of smokers among a randomly chosen sample of 30 adults. What is the probability model for X? Name the model (including its parameters) and specify the mean of X.

$G(.18)$ OR

Geometric Model with $p = .18$

$\mu = 1/p = 1/.18$

$\boxed{\mu = 5.56 \text{ smokers}}$

4) **Bowling** A large corporation sponsors bowling leagues for its employees. The mean score for men was 154 pins with a standard deviation of 9 pins, while the women had mean score 144 pins and standard deviation 12 pins. At the end of the season the league holds a tournament that randomly pairs men and women as opponents in the first round.

a. On average, how much do you expect the man to win by?

E(Men MORE THAN WOMEN) $= E(M-W) = 154 - 144 = 10$ pins

b. Estimate the standard deviation of the differences in the competitor's scores.

$VAR(M-W) = 9^2 + 12^2 = 225$

$\sigma_{M-W} = 15$ pins

c. What assumption did you make in determining the standard deviation?

The scores of men and women are independent

$P = .05$

The owner of a small convenience store is trying to decide whether to discontinue selling magazines. He suspects that only 5% of the customers buy a magazine and thinks that he might be able to use the display space to sell something more profitable. Before making a final decision he decides that for one day he'll keep track of the number of customers and whether or not they buy a magazine.

5) What is the probability that at least 5 of his first 50 customers buy magazines? $n = 50$ $B(50, .05)$

$$P(X \geq 5) = 1 - P(X \leq 4) = 1 - \text{binomcdf}(50, .05, 4) = .1036$$

The probability of atleast 5 out of 50 Customers is about 10%

6) He had 280 customers that day. Assuming this day was typical for his store, what would be the mean and standard deviation of the number of customers who buy magazines each day?

$B(280, .05)$ $\mu = np = 280(.05)$

$\mu = 14$ Customers

$\sigma = \sqrt{n\,p(1-p)}$

$= \sqrt{280\,(.05)(.95)}$

$= \sqrt{13.3} = 3.6469$

$\sigma = 3.65$ customers

7) What is the probability that exactly 2 of the first 10 customers buy magazines? Show work.

$B(10, .05)$

$$P(X=2) = \text{binom pdf}(10, .05, 2) = .0746$$

The probability of exactly 2 out of 10 customers is about 7% buy the magazine

8) Assuming the owner is correct in thinking that 5% of the customers purchase magazines, how many customers should he expect before someone buys a magazine?

$G(.05)$

$$E(x) = 1/p = 1/.05 = 20.$$

$\boxed{\mu = 20}$

We would expect, on average, the 20Th Customer would be the first to buy a magazine

$\mu_D = \$600 \quad \sigma_D = \$30 \qquad \mu_C = \$120 \quad \sigma_C = \$35$

9) The American Veterinary Association claims that the annual cost of medical care for dogs averages $100 with a standard deviation of $30, and for cats averages $120 with a standard deviation of $35.

a. Find the expected value for the annual cost of medical care for a person who has one dog and one cat.

$E(D+C) = E(D) + E(C) = 100 + 120 = \$220$

b. Find the standard deviation for the annual cost of medical care for a person who has one dog and one cat.

$VAR(D+C) = 30^2 + 35^2 = 2125$

$\boxed{\sigma_{D+C} = \$46.10}$

c. Suppose that a couple owns four dogs.

i. Find the expected value for the annual cost of medical care for the couple's dogs.

$E(4\ \text{DOGS}) = 4(100) = \$400$

ii. Find the standard deviation for the annual cost of medical care for the couple's dogs.

$VAR(4\ \text{DOGS}) = 30^2 + 30^2 + 30^2 + 30^2 = 3{,}600$

$\boxed{\sigma_{4D} = \$60}$

10) **Home ownership** According to the Bureau of the Census, 68.0% of Americans owned their own homes in 2003. A local real estate office is curious as to whether a higher percentage of Americans own their own homes in its area. The office selects a random sample of 200 people in the area to estimate the percentage of those people that own their own homes.

$n = 200 \qquad p = .68 \qquad 1-p = q = .32$

a. Verify that a Normal model is a useful approximation for the Binomial in this situation. Clearly show your work.

$np = (200)(.68) = 136 \geq 10$

$nq = (200)(.32) = 64 \geq 10$

A Normal model can be used to approximate the binomial

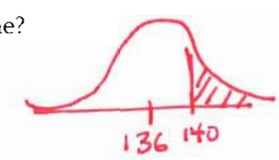
**BONUS:** What is the probability that at least 140 people will report owning their own home?

$\mu = np = 136$

$\sigma = \sqrt{npq} = 6.6$

$N(136, 6.6)$

$P(X \geq 140) =$




normalcdf(140, 1E99, 136, 66) = .272



The probability 140+ people reported owning their house is about 27%

1) a. Let $M$ = height of men and $W$ = height of women.

i. $E[M - W] = E[M] - E[W] = 69.1 - 64.0 = 5.1$"

ii. $Var(M - W) = Var(M) + Var(W) = 2.8^2 + 2.5^2 = 14.09$, so $SD(M - W) = \sqrt{14.09} = 3.75$"

b. Let $D = M - W$. We want to know the probability that $D < 0$.

$$P(D < 0) = P\left(z < \frac{0 - 5.1}{3.75}\right) = P(z < -1.36) = 0.0869$$

2) a.

| X (total) | 3 | 5 | 7 | 9 |
|---|---|---|---|---|
| P(x) | $4/36$ | $20/36$ | $2/36$ | $10/36$ |

b. 6

c. 2.03

3) a. 2 outcomes (smoke, not), p = 18%, not independent but random and < 10% of adults

b. $\frac{1}{0.18} = 5.6$

c. $Binom(30, 0.18)$; $\mu = 5.4$; SD = 2.1

d. $P(X \geq 8) = \binom{30}{8}(0.18)^8(0.82)^{22} + \binom{30}{9}(0.18)^9(0.82)^{21} + \ldots + \binom{30}{30}(0.18)^{30}(0.82)^0 = 16\%$

or more likely:

$$P(X \geq 8) = 1 - \left[\binom{30}{0}(0.18)^0(0.82)^{30} + \ldots + \binom{30}{7}(0.18)^7(0.82)^{23}\right] = 16\%$$

4) a. 10

b. 15

c. The scores for the man and woman are independent.

5) $P(X > 5) = 1 - P(X \leq 4) = 1 - \left[\binom{50}{0}(0.05)^0(0.95)^{50} + \ldots + \binom{50}{4}(0.05)^4(0.95)^{46}\right] = 1 - 0.896 = 0.104$

6) $\mu = (280)(0.05) = 14$; $\sigma = \sqrt{(280)(0.05)(0.95)} = 3.65$

7) Using the Binomial model, $Binom(10, 0.05)$

$$P(\text{2 of 10 customers buy magazines}) \binom{10}{2}(0.05)^2(0.95)^8 = 0.075$$

8) Expected value of Geometric model: $\mu = \frac{1}{p} = \frac{1}{0.05} = 20$

9) a. $E(D + C) = E(D) + E(C) = \$100 + \$120 = \$220$

b. $Var(D + C) = Var(D) + Var(C) = 30^2 + 35^2 = 2125$, so $SD(D + C) = \sqrt{2125} = \$46.10$

c. i. $E(D_1 + D_2 + D_3 + D_4) = \$100 + \$100 + \$100 + \$100 = \$400$

ii. $Var(D_1 + D_2 + D_3 + D_4) = 30^2 + 30^2 + 30^2 + 30^2 = 3600$, so $SD(D_1 + D_2 + D_3 + D_4) = \sqrt{3600} = \$60$

10) a. $np = 200(0.68) = 136 \geq 10$ and $nq = 200(0.32) = 64 \geq 10$ , and 200 people is less than 10% of the people in the area. A Normal model can be used to approximate the Binomial.

b. $P(X \geq 140) = P\left(z \geq \frac{140 - 200(0.68)}{\sqrt{200(0.68)(0.32)}}\right) = P(z \geq +0.61) = 0.2709$

c. It would be unusual to see a number of homeowners that was more than 2 standard deviations above the mean. With a mean of 136 and a standard deviation of 6.60, it would be unusual to see 136 + 2(6.60) = 149.2 or more homeowners in the area. I would be convinced that a higher percentage of Americans own their own homes in that area if at least 150 of the 200 people owned their own homes.

# AP Statistics – Chapter 7 Test Version B

Name________________________________

**Part 1 (3 pts each – Total 21 pts): MULTIPLE CHOICE. Choose the one alternative that best answers the question.**

1) A national study found that the average family spent \$422 a month on groceries, with a standard deviation of \$84. The average amount spent on housing (rent or mortgage) was \$1120 a month, with standard deviation \$212. The expected total a family spends on food and housing is 422 + 1120 = \$1542. What is the standard deviation of the total?

Tip: read carefully to determine correct method and conditions.

   A) It cannot be determined.
   B) \$295
   C) \$148
   D) \$228
   E) \$128

2) Which of these random variables is most likely to have a binomial model?
   A) The number of Democrats among a group of 20 randomly chosen adults.
   B) The number of aces among the top 10 cards in a well-shuffled deck.
   C) The number of people we check until we find someone with green eyes.
   D) The number of cards of each suit in a 10-card hand.
   E) The number of cars inspected until we find three with bad mufflers.

3) Pepsi is running a sales promotion in which 12% of all bottles have a "FREE" logo under the cap. What is the probability that you find two free ones in a 6-pack?

A) 1% B) 97% C) 11% D) 13% E) 23%

4) A supermarket claims that their checkout scanners correctly price 99.8% of the items sold. How many items would you expect to buy, on average, to find one that scans incorrectly?

A) 500 B) 99.8 C) 200 D) 998 E) 2

5) Which of these random variables has a geometric model?
   A) The number of cars inspected until we find three with bad mufflers.
   B) The number of cards of each suit in a 10-card hand.
   C) The number of people we check until we find someone with green eyes.
   D) The number of Democrats among a group of 20 randomly chosen adults.
   E) The number of aces among the top 10 cards in a well-shuffled deck.

6) Some marathons allow two runners to "split" the marathon by each running a half marathon. Alice and Sharon plan to split a marathon. Alice's half-marathon times average 92 minutes with a standard deviation of 4 minutes, and Sharon's half-marathon times average 96 minutes with a standard deviation of 2 minutes. Assume that the women's half-marathon times are independent. The expected time for Alice and Sharon to complete a full marathon is 92 + 96 = 188 minutes. What is the standard deviation of their total time?
   A) It cannot be determined.
   B) 2 minutes
   C) 4.5 minutes
   D) 20 minutes
   E) 6 minutes

## AP Statistics – Chapter 7B Test

**Part 2 (4 pts each sub question). SHORT ANSWER. Clearly show your work. Always check conditions have been met, identify the distribution model (including its parameters), using the correct statistical notation when giving answers (do not simply give a number); and when asked write answer c learly in context.**

1) **Basketball player heights** Assume the heights of high school basketball players are normally distributed. For boys the mean is 74 inches with a standard deviation of 4.5 inches, while girl players have a mean height of 70 inches and standard deviation 3 inches. At a mixed 2-on-2 tournament teams are formed by randomly pairing boys with girls as teammates.

$\mu_B = 74$ in  $\mu_G = 70$ in
$\sigma_B = 4.5$ in  $\sigma_G = 3$ in

a. On average, how much taller do you expect the boy to be?

$E(B-G) = 74 - 70 = 4$ inches taller  $\mu_{B-G} = 4$ in

b. What will be the standard deviation of the difference in teammates' heights?

$VAR(B-G) = 4.5^2 + 3^2 = 29.25$  $\sigma_{B-G} = 5.41$ inches

c. On what fraction of the teams would you expect the girl to be taller than the boy?

$N(4, 5.4)$  $P(G > B) = P(B-G < 0) = \text{normalcdf}(-1E99, 0, 4, 5.4)$
$-G \quad -G$  $= .2294$
$0 > B-G$

APPROX 23% of Girls are taller than the boys

2) A biology professor responds to some student questions by e-mail. The probability model below describes the number of e-mails that the professor may receive from students during a day.

$X =$ # Emails received

| E-mails received | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Probability | 0.05 | 0.10 | 0.20 | 0.25 | 0.30 | 0.10 |

a. How many e-mails should the professor expect to receive each day? Write you answer in context; OR use the appropriate notation when stating your answer.

$E(X) = 0(.05) + 1(.1) + 2(.2) + 3(.25) + (4)(.30) + 5(.1) = 2.95$ emails

$E(X) = \mu_X = 2.95$ emails

b. What is the standard deviation? Use the appropriate notation when stating your answer.

$VAR(X) = 1.7475$  $\sigma_X = 1.32$ emails per day

c. If it takes the professor an average of ten minutes to respond to each e-mail, how much time should the professor expect to spend responding to student e-mails each day?

$Y =$ amount of time answering emails

$E(Y) = 10 \cdot E(X) = 10(2.95) = 29.5$ minutes per day answering emails

3) **Credit card sales** The National Association of Retailers reports that 62% of all purchases are now made by credit card; you think this is true at your store as well. On a typical day you make 20 sales.

a. Explain why your sales can be considered Bernoulli trials( either binomial, geometric, ~~or normal~~) Explain and state 4 conditions to support your decision.

B 2 outcomes (Credit card, other)
I Independent (one transaction does not influence the next transaction)
N Fixed # trials $n = 20$
S Fixed probability $p = .62$

c. Let X represent the number of customers who use a credit card on a typical day. What is the probability model for X? Specify the model (name and parameters), and tell the mean and standard deviation.

$B(20, .62)$ $\mu = np = 20(.62)$ $\mu = 12.4$

$\sigma = \sqrt{npq} = \sqrt{20(.62)(.38)}$ $\sigma = 2.17$

4) The American Veterinary Association claims that the annual cost of medical care for dogs averages \$100 with a standard deviation of \$30, and for cats averages \$120 with a standard deviation of \$35.

a. Find the expected value for the annual cost of medical care for a person who has one dog and one cat.

$E(D+C) = 100 + 120 = \$220$

b. Find the standard deviation for the annual cost of medical care for a person who has one dog and one cat.

$VAR(D+C) = 30^2 + 35^2 = 2125$

$\sigma_{D+C} = \$46.10$

c. Suppose that a couple owns four dogs.

i. Find the expected value for the annual cost of medical care for the couple's dogs

$E(4\ DOGS) = 4(100) = \$400$

ii. Find the standard deviation for the annual cost of medical care for the couple's dogs.

$VAR(4\ DOGS) = 4(30^2) = 3600$

$\sigma_{4 DOGS} = \$60$

The owner of a pet store is trying to decide whether to discontinue selling specialty clothes for pets. She suspects that only 4% of the customers buy specialty clothes for their pets and thinks that she might be able to replace the clothes with more interesting and profitable items on the shelves. Before making a final decision she decides to keep track of the total number of customers for a day, and whether they purchase specialty clothes for their pet.

5) What is the probability that at least 3 of the first ~~40~~ 25 customers buy specialty clothes for their pet? Show work.

$B(25, .04)$ $\quad P(X \geq 3) = 1 - P(X \leq 2)$

$= 1 - \text{binomcdf}(25, .04, 2) = .0765$

About 8% of the customers (at least 3) bought pet clothes

6) The owner had 275 customers that day. Assuming this was a typical day for her store, what would be the mean and standard deviation of the number of customers who buy specialty clothes for their pet each day?

$B(275, .04)$ $\quad E(X) = \mu_x = np = (275)(.04) = \boxed{11 \text{ customers/day}}$

$VAR(X) = \sqrt{npq} = \sqrt{(275)(.04)(.96)} = \sqrt{10.56} \doteq$ 3.25 customers per day

7) What is the probability that exactly 3 of the first 10 customers buy specialty clothes for their pet? Show work.

$B(10, .04)$ $\quad P(X=3) = \text{binompdf}(10, .04, 3) = .00577$

The probability of exactly 3 is less than 1%

8) Assuming the pet store owner is correct in thinking that only 4% of her customers purchase specialty clothes for their pets, how many customers should she expect before someone buys a garment for their pet?

$G(.04)$ $\quad E(X) = 1/.04 = 25$

We would expect, on average, that the 25th customer would buy pet clothes

9) **Bowling** A large corporation sponsors bowling leagues for its employees. The mean score for men was 154 pins with a standard deviation of 9 pins, while the women had mean score 144 pins and standard deviation 12 pins. At the end of the season the league holds a tournament that randomly pairs men and women as opponents in the first round.

a. On average, how much do you expect the man to win by?

$E(m-w) = E(m) - E(w) = 154 - 144 = 10$ pins

b. Estimate the standard deviation of the differences in the competitor's scores.

$VAR(m-w) = 9^2 + 12^2 = 225$

$\sigma_{m-w} = 15$ pins

c. What assumption did you make in determining the standard deviation?

The scores for men and women are independent

10) **Seatbelts** Safety officials hope a public information campaign will increase the use of seatbelts above the current 70% level. Their efforts include running radio and TV ads, putting up billboards, having police officers appear on talk shows, and getting newspapers to indicate whether people injured in accidents were belted in. After several months they check the effectiveness of this campaign with a statewide survey of 560 randomly chosen drivers. 407 of those drivers report that they wear a seatbelt. $N = 560 \quad p = .7$

a. Verify that a Normal model is a good approximation for the binomial model in this situation. Clearly show your work:

$np = 560(.7) \geq 10$

$392 \geq 10$

$nq = 560(.3) = 168 \geq 10$

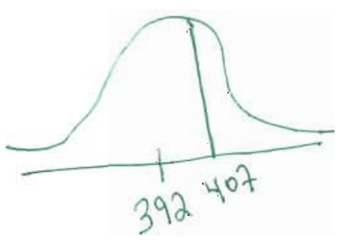
Since both are at least 10, the sample is large enough to have the normal distribution approximate the binomial

**BONUS:** Does the survey result suggest that the education/advertising campaign was effective? Explain using supporting statistics such as probability, mean, standard deviation, etc.

$N(392, 10.84)$

$\mu = np = 560(.7) = 392$

$\sigma = \sqrt{npq} = \sqrt{560(.7)(.3)} = \sqrt{117.6} = 10.84$




① normalcdf(-1E99, 407, 392, 10.84) = .916

② $z = \frac{407-392}{10.84} = 1.38$

These are not unusually high results, so the campaign may not have been highly effective

1) a. $E(B - G) = E(B) - E(G) = 74 - 70 = 4$ inches
b. $Var(B - G) = Var(B) + Var(G) = (4.5)^2 + (3)^2 = 29.25$. $SD(X) = \sqrt{29.25} = 5.4$
c. Let $D$ = difference between boy's height minus girl's height
$P(D < 0) = P\left(z < \frac{0 - 4}{5.4}\right) = P(z < -0.7407) = 0.2294$
So, about 22.94% of the time you could expect the girl to be taller than the boy.

2) a. Let X = number of e-mails received.
$E(X) = 0(0.05) + 1(0.10) + 2(0.20) + 3(0.25) + 4(0.30) + 5(0.10) = 2.95$ e-mails per day
b. $Var(X) = (0 - 2.95)^2 (0.05) + (1 - 2.95)^2 (0.10) + (2 - 2.95)^2 (0.20)$
$+ (3 - 2.95)^2 (0.25) + (4 - 2.95)^2 (0.30) + (5 - 2.95)^2 (0.10)$
$= 1.7475$
$SD(X) = \sqrt{1.7475} = 1.32$ e-mails per day
c. Let Y = amount of time spent responding to e-mails
$Y = X_1 + X_2 + ... + X_{10}$
$E(Y) = E(X_1 + X_2 + ... + X_{10}) = E(X_1) + E(X_2) + ... + E(X_{10}) = 2.95 + 2.95 + ... + 2.95 = 29.5$ minutes per day

3) a. Bernoulli trials have only two possible outcomes (success = credit/failure = other), trials are independent (one transaction does not influence the next transaction), and the probability of success stays constant on every trial (62% of all purchases).
b. $P$(first credit card on fourth sale) = $P$(3 other sales, then credit sale) = $(0.38)^3(0.62) = 0.034$
c. Model: Binom(20, 0.62)
Mean: $\mu = np = (20)(0.62) = 12.4$,
SD: $\sigma = \sqrt{npq} = \sqrt{(20)(0.62)(0.38)} = 2.17$
d. $P(X \geq 10) = 1 - P(x \leq 9) = 1 - \left[\binom{20}{0}(0.62)^0(0.38)^{20} + ... + \binom{20}{9}(0.62)^9(0.38)^{11}\right] = 1 - 0.0923 = 0.9077$

4) a. $E(D + C) = E(D) + E(C) = \$100 + \$120 = \$220$
b. $Var(D + C) = Var(D) + Var(C) = 30^2 + 35^2 = 2125$, so $SD(D + C) = \sqrt{2125} = \$46.10$
c. i. $E(D_1 + D_2 + D_3 + D_4) = \$100 + \$100 + \$100 + \$100 = \$400$
ii. $Var(D_1 + D_2 + D_3 + D_4) = 30^2 + 30^2 + 30^2 + 30^2 = 3600$, so $SD(D_1 + D_2 + D_3 + D_4) = \sqrt{3600} = \$60$

5) $P(X \geq 3) = 1 - P(X \leq 2)$
$= 1 - \left[\binom{10}{0}(0.04)^0(0.96)^{10} + \binom{10}{1}(0.04)^1(0.96)^9 + \binom{10}{2}(0.04)^2(0.96)^8\right] = 1 - 0.9937 = 0.063$

6) Using the Binomial model, mean: $\mu = np = (275)(0.04) = 11$
Standard deviation: $\sigma = \sqrt{npq} = \sqrt{(275)(0.04)(0.96)} = 3.25$

7) $P$(exactly 3 out of 10) = $P(X = 3) = \binom{10}{3}(0.04)^3(0.96)^7 = 0.00577$

8) Expected value of Geometric model: $\mu = \frac{1}{p} = \frac{1}{0.04} = 25$

9) a. 10
b. 15
c. The scores for the man and woman are independent.

10) a. $np = 560(0.7) = 392$, $nq = 168$; since both are at least 10 the sample is large enough
b. Use N(392, 10.84) to see $z = 1.38$. This is not an unusually high result, so the campaign may not have been effective.