S370 HOMEWORK 3, SPRING 2010, PROF. W. E. BECKER

Binomial: Ex 5.1, 5.9, 5.14, 5.15, and 5.34. Normal: Ex 6.1, 6.5, 6.6, 6.15, 6.17, 6.22, and 6.23.

5.1

- **a.** $P(X \leq 7 \mid n=20, \pi=0.3)$ = BINOMDIST(7,20,0.3,1) = **0.772**
- **b.** $P(Y=3 \mid n=10, \pi=0.7)$ = BINOMDIST(3,10,0.7,0) = **0.009**
- **c.** $P(2 < W \leq 9 \mid n=30, \pi=0.2)$
  = BINOMDIST(9,30,0.2,1) - BINOMDIST(2,30,0.2,1) = 0.938913-0.044179 = **0.894734**
- **d.** $P(U > 10 \mid n=12, \pi=0.75)$ = 1 - BINOMDIST(10,12,0.75,1) = **0.158382**

5.9

From the given information, π =0.667 and n=10 where π is the probability of a restaurant substituting pork for veal. Thus, letting X be the number of restaurants that do this substitution, $P(X > 5 \mid n=10, \pi=0.667)$ = 1- BINOMDIST(5,10,0.667,1) = **0.7**88

5.14

- **a.** Expected number of users out of three is: 3 *.07=**2.1**. This number means that if an infinite amount of independent samples of size 3 is drawn from a population of Nordic Track users, then the average number of people who use it at least three hours per week will be 2.1.
- **b.** The probability of drawing a random sample of three with no regular users five years later is: =BINOMDIST(0,3,.7,0) = **0.027**.

5.15

If the probability of such an event occurring (0.027) under the assumption of the probability of success being 0.7 is viewed as extremely small (zero is far below 2.1), we can say that our observation is inconsistent with the assumption. That is, we reject Nordic Track's claim. On the other hand, if 0.027 is viewed as not being extremely small (zero is not far below 2.1), then the Nordic Track's claim will not be rejected.

5.34

If only guessing is involved, the probability that a blindfolded woman would correctly identify his or her partner is pi=1/3. $P(X \geq 50 \mid n=72, \pi=1/3) = 1 - P(X \leq 49 \mid n=72, \pi=1/3)$ = 1 - BINOMDIST(49,72,1/3,1) = 4.23256E-10. This probability is too small to lead us to believe that they were just guessing in the identification of their partners.

6.1

- **a.** Discrete
- **b.** Continuous
- **c.** Discrete
- **d.** Continuous

6.5 $X \sim N(5,2)$

- **a.** $P(x < 2)$ = NORMDIST(2,5,2,1) = **0.066807**;
- **b.** $P(2 < x < 6.4)$ = NORMDIST(6.4,5,2,1) - NORMDIST(2,5,2,1) = 0.758036 - 0.066807 = **0.69123**;

c. P(-1 < x < 0) = NORMDIST(0,5,2,1) - NORMDIST(-1,5,2,1) = 0.00621 - 0.00135 = **0.00486**;
d. P(x < 6.4) = NORMDIST(6.4,5,2,1) = **0.758036**;
e. P(x > -2) = 1 - P(x < -2) = 1 - NORMDIST(-2,5,2,1) = 1 - 0.000233 = **0.999767**
f. P(x > 6.23) = 1 - P(x < 6.23) = 1 - NORMDIST(6.23,5,2,1) = 1 - 0.7302723 = **0.269277**

6.6 Y ~ N(25,9)

a. P(y greater than b) = 0.0007, then b = NORMINV(0,9993,25,9) = **53.75255**
b. P(y greater than b) = 0.055, then b= NORMINV(0.945,25,9) = **39.38372**
c. P(y less than b) = 0.9948, then b = NORMINV(0.9948,25,9) = **48.06006**
d. P(b greater than y greater than 25) = .032, then b = NORMINV(.532,25,9) = **25.7227**
e. P(b less than y less than 25) = 0.5429 – this is impossible, because the area under the normal curve less the mean can only be less than or equal to 0.5.
f. P(y less than b)=0.2123, then b = NORMINV(0.2123,25,9) = **17.81381**

6.15

X ~ N(μ,0.3). You need to know μ so that the event x greater than 8 occurs only one percent of the time. Take z ~ N(0,1). The value NORMSINV(0.99) = 2.326, is how many standard deviations above the mean one has to go to see the event occurring 1% of the time. Thus, in our problem, 8 is 2.326 standard deviations above the mean, the mean is then 8 - (0.03 * 2.326) = **7.3 oz**.

6.17

Y ~ N(90,18). Since, 108 is roughly one standard deviation above the mean, and 72 is roughly one standard deviation below the mean, the probabilities of an observation occurring in each of these areas are both equal to about 34% (half of 68%).

6.22

X ~ N(81,10). The probability of selecting a person who worked for more than 100 days to pay taxes is 1 - NORMDIST(100, 81,10, 1) = 1 - 0.0971284 = **0.028716**.

6.23

X ~ N(7,σ). To find out how many standard deviations away is the left-tail area of 14%, use NORMINV(0.14,0,1) = -1.08. Therefore, the six-year difference between the seventh year (the mean) and the first year should correspond to 1.08 standard deviations below the mean. Therefore, the standard deviation is equal to 6/1.08 **= 5.5556 years**.

Grading guideline:

1. A correct Excel functional form earns you 0.5 points.
2. Each parameter in the Excel function is worth 0.5 points.
3. Correct function and correct number plugged in will give you full points, regardless the final numerical answer is correct or not.
4. In the case where you screwed up with the Excel function, correct identification of n and π (or μ and σ) will help you get 0.5 points.
5. If you forgot to use “1-” for a right-tail probability, it will cost you 0.5 points.

Point allocation:

5.1 2.5’ + 2.5’ + 5’ + 3’ = 13’

5.9 3.5’

5.14 3’ + 3’ + 3’ = 9’

5.15 5’

5.34 3.5’ + 3’ = 6.5’

6.1 2’× 4 = 8’

6.5 2.5’ + 5’ + 5’ + 2.5’ + 3’ + 3’ = 21’

6.6 2’ + 2’ + 2’ + 2’ + 1’ + 2’ = 11’

6.15 6’

6.17 5’

6.22 6’

6.23 6’