Name: Key

Due: Wednesday, March 20 1st half of class
Lab #6 – M200 F12

In a random sample of 10 cars in a faculty lot at a local community college, it was noted if the car was a hybrid or not. The following is the result:

Hybrid (1) **Not** **Not** **Not** **Not** **Not** **Not** **Not** **Not** **Hybrid** (2)

1. Give the values for n, p & q for this binomially distributed random variable.

$n = 10$ $\quad p = \frac{2}{10} = 0.2$ $\quad q = 1 - \frac{2}{10} = \frac{8}{10} = 0.8$

2. In a sample of 82 faculty cars what is the probability, according to the binomial distribution of finding exactly 8 cars that are hybrid? Use correct notation, show the input into the binomial formula & then give the probability probability and round to 3 significant decimals (if in scientific notation).

$$P(X=8) = \frac{82!}{82-8!\,8!}(0.2)^8(0.8)^{82-8} \doteq 0.00615$$

binompdf(82, 0.2, 8)

3. In a sample of 82 faculty cars what is the probability, according to the binomial distribution of finding fewer than 8 cars that are hybrid? Use correct notation, show the input into your calculator for giving the probability and round to 3 significant decimals (if in scientific notation).

$$P(X<8) = P(X=0) + P(X=1) + \cdots + P(X=7) \doteq 0.00399$$

$P(X \le 7) \Rightarrow$ binomcdf(82, 0.2, 7)

4. Ten to twenty years ago, the calculation that you performed in questions 2 and 3 would have been very time consuming or have required the use of a very expensive and large computer. As a result the computations were rarely done

using the binomial distribution. Instead the NORMAL (fill in the blank) approximation to the binomial was done.

5. Calculate the mean and standard deviation to be used for this approximation.

$\mu = np = 82(0.2) = 16.4$ $\quad \sigma = \sqrt{npq} = \sqrt{16.4(0.8)} = \sqrt{13.12} \doteq 3.622154$

6. Re-compute the probability in #2 using the approximation named in #4. Make sure that you show the continuity correction. Standardization must be used on the continuity corrected random variable to arrive at the final value from which you should calculate a probability.

$$P(X_B = 8) = P(7.5 < X_N < 8.5) = P\left(\frac{7.5-16.4}{3.622154} < \frac{X_N - \mu}{\sigma} < \frac{8.5-16.4}{3.622154}\right)$$

$$= P(-2.46 < Z < -2.18) = P(Z<-2.18) - P(Z<-2.46)$$

$$\overset{\text{Table}}{=} 0.0146 - 0.0069 = 0.0077$$

normalcdf(-2.46, -2.18) $= 0.00768 \approx 0.0077$

Conditions for normal approx are met $np = 16.4 \ge 5$, $nq = 65.6 \ge 5$

7. Re-compute the probability in #3 using the approximation named in #4. Make sure that you show the continuity correction. Standardization must be used on the continuity corrected random variable to arrive at the final value from which you should calculate a probability.

$$P(X_B < 8) = P(X_N \leq 7.5) = P\left(\frac{X_N - \mu}{\sigma} < \frac{7.5 - 16.4}{3.622154}\right) = P(Z <$$

$$= P(Z < -2.46) = \boxed{0.0069} \quad \text{(Table)}$$

normalcdf(-E10, -2.46) = 0.0069

8. Using the value for p, as computed in question 1, as the point estimate for the population proportion, fill in the blanks for the sampling distribution of p-hats for a sample of 82. We will discuss this in class, but Triola may not discuss this as well as he once did.

p-hat ~ N (0.2 , $\sqrt{\frac{(0.8)(0.2)}{82}}$)

≈ 0.044173

EC Using the sampling distribution of proportions found in #8, what is the probability of observing more than 30% hybrid vehicles in samples of 82? Correctly write the probability, don't forget continuity correction ($^{0.5}/_{n}$), show the standardization and then use the correct distribution to find this probability. (If you input the values into your calculator's distributions functions show your input.)

$$P(X_B > 0.3) = P(X_N > 0.3 + 0.5/82) = P(X_N > 0.306098)$$

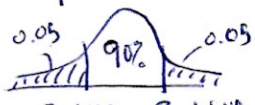
$$= P\left(\frac{X_N - \mu}{\sigma} > \frac{0.306098 - 0.2}{0.044173}\right) = P(Z > -3.83)$$

$$= 1 - P(Z \leq -3.83) = 1 - 0.0001 \doteq \boxed{0.9999} \quad \text{(Table)}$$

normalcdf(-3.83, E10) $\doteq$ 0.9999

9. Give a 90% confidence interval for the true proportion of hybrid vehicles found in samples of 82 based on the sampling distribution in #8. You must show a) finding the critical value, b) computation of the margin of error, c) the interval given with the population proportion in the middle of a compound inequality.

$\hat{p} = 0.2$



invNorm(0.05)
or = in Table find 0.05 in body (Neg Z)
or = in t-table find 0.05 in one tail in last row locate C.V. for Z

$$E = 1.645\sqrt{\frac{(0.8)(0.2)}{82}} \doteq 0.07267$$

$$\hat{p} \pm E \Rightarrow 0.2 \pm 0.07267$$

$$\boxed{0.127 < p < 0.273}$$