

Quiz 6

Key

Math 1040–1

July 20, 2012

Directions: Show all work for full credit. Clearly indicate all answers. Simplify all mathematical expressions completely. Unless otherwise directed, give each decimal approximation rounded to at least three decimal places.

Formulas

$$\sigma = \sqrt{npq} \quad (\text{for a Binomial Distribution})$$

$$r = \frac{n \sum(xy) - (\sum x)(\sum y)}{\sqrt{n \sum(x^2) - (\sum x)^2} \sqrt{n \sum(y^2) - (\sum y)^2}}$$

1. A survey of U.S. adults found that 35% say their favorite sport is professional football. You randomly select 150 adults and ask them if their favorite sport is professional football. (#25 from 5.5, shortened)

- (a) Can you use a normal distribution to approximate this binomial distribution? Why or why not? (5 points)

Yes, the normal distribution can be used. Since $n = 150$, $p = .35$, and $q = .65$, both np and nq are at least 5.

- (b) Using the normal approximation, find the probability that more than 40 people say their favorite sport is professional football. (15 points)

Note that “more than 40” is the same as “at least 41.” Using the continuity correction, we need to consider the probability of a normal random variable being more than 40.5. The mean of this random variable is $np = 150 \cdot 0.35 = 52.5$ and the standard deviation is $\sigma = \sqrt{npq} = \sqrt{150 \cdot 0.35 \cdot 0.65} \approx 5.84166$. Then, we need to calculate the z -score:

$$z = \frac{40.5 - 52.5}{5.84166} = -2.05,$$

so the probability of being above this z -score is $1 - 0.0202 = 0.9798$.

- (c) Using the normal approximation, find the probability that between 50 and 60 people, inclusive, say their favorite sport is professional football. (15 points)

With the continuity correction, we will need to consider the probability that a normal random variable is between 49.5 and 60.5. Since the mean and standard deviation are the same as we calculated in part b, the z -scores are:

$$z = \frac{49.5 - 52.5}{5.84166} = -.51$$

$$z = \frac{60.5 - 52.5}{5.84166} = 1.37, \text{ so the probability of being between these is}$$

$$0.9147 - 0.3050 = .6097$$

2. The number of hours 5 students spent studying for a test and their test scores on that test are:

Hours spent studying, x	0	2	4	6	8
Test score, y	40	51	48	68	95

(A shorter version of #23 from 9.1)

- (a) Calculate the correlation coefficient, r . (20 points)

We will use the formula for r given on the front, so first we will calculate:

$$\begin{aligned}n &= 5 \\ \sum x &= 20 \\ \sum y &= 302 \\ \sum x^2 &= 120 \\ \sum y^2 &= 20154 \\ \sum xy &= 1462 \quad \text{Using the given formula,} \\ r &= \frac{5 \cdot 1462 - 20 \cdot 302}{\sqrt{5 \cdot 120 - 20^2} \sqrt{5 \cdot 20154 - 302^2}} = 0.918\end{aligned}$$

- (b) Is the linear correlation positive or negative, or is there no linear correlation? Explain your answer. (5 points)

The linear correlation is positive, since the answer to part a is positive. Instead, you could use the argument that as the x -values increase, the y -values also tend to increase.