Math 1530 Final Exam Fall 2014

Name _____
Section # _____
Instructor _____

There are five possible responses to each of the following multiple choice questions. There is only one "BEST" answer. Be sure to read all possible choices before selecting your answer. You may mark on this examination. You can use a calculator but a calculator manual cannot be used.

Form A

Please circle your answer to each question and fill the blank sheet. After you finish the exam, log into D2L and input your answers under the right quiz item. There are a total of 43 questions.

- If your test is Form A, take Quiz item *Final Form A*.
- If your test is Form B, take Quiz item *Final Form B*.
- If your test is Form C, take Quiz item *Final Form C*.
- If your test is Form D, take Quiz item *Final Form D*.

CONFIDENCE LEVEL	90%	95%	99%
z^*	1.645	1.96	2.576

1. Which of these questions from the Fall 2014 MATH1530 class survey produced variables that are categorical?

   i. What is your opinion about a married person having sexual relations with someone other than their marriage partner (Always wrong, Almost always wrong, Wrong only sometimes, Not wrong at all)?

   ii. What do you think is the ideal number of children for a family to have?

   iii. Do you favor or oppose the death penalty for persons convicted of murder (Favor, Oppose)?

   iv. How many pairs of shoes do you own?

   v. Usually, how many hours sleep do you get a night?

   (A) i, iii. (B) ii, iii. (C) i, iv, v. (D) ii. (E) iii.

2. The Fall 2014 MATH1530 class survey asked "What do you think is the ideal number of children for a family to have?" The table below represents the responses of 1205 students.

Number of Children	0	1	2	3	4	5	6 or more
Number of Students	35	44	601	357	131	23	14

   The median number of the ideal number of children for a family to have for these 1205 students is

   (A) 603 (B) 44 (C) 3 (D) 2 (E) Unable to determine from the given information.

3. If you were told a population has a mean of 25 and a variance of 0, what must you conclude?

   (A) The data are probably bell-shaped.

   (B) There is very little variation in the data.

   (C) All the values in the population are 25.

   (D) 95% of the data values lie between $25 \pm 2\sqrt{0}$.

   (E) Not sure without looking at a graph and the five-number summary.

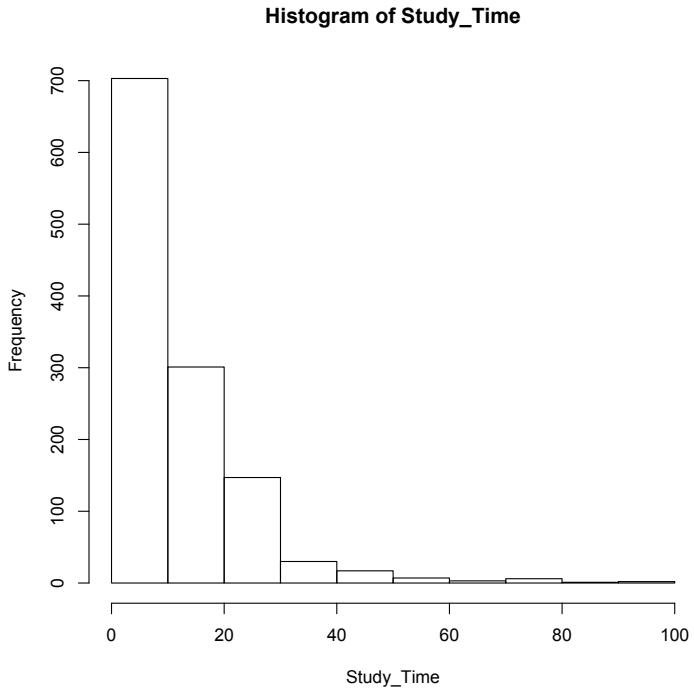
4. The table below represents the responses of 1214 students to the MATH1530 survey question "Do you strongly agree, agree, disagree, or strongly disagree that it is sometimes necessary to discipline a child with a good, hand spanking?"

Discipline	Strongly Disagree	Disagree	Agree	Strongly Agree
Counts	80	134	481	519

Which type of graph is appropriate for these data?

(A) Histogram (B) Stem Plot (C) Scatterplot (D) Boxplot (E) Bar Chart

Use the following for the next 3 questions. The Fall 2014 MATH 1530 class survey asked "How many hours per 7-day week do you spend preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)?" The histogram and summary statistics below are based on the number of hours spent preparing for class of 1217 students.



Mean	Standard Deviation	Minimum	1st Quartile	Median	3rd Quartile	Maximum
13.2	11.7	0	5	10	16	100

5. Which of the following best describes the shape of the distribution?

(A) The distribution is skewed right with possible outliers. (C) The distribution is skewed left with outliers.

(B) The distribution is bell-shaped. (D) The center is 10.

(E) The distribution is fairly uniform from 0 to 100.

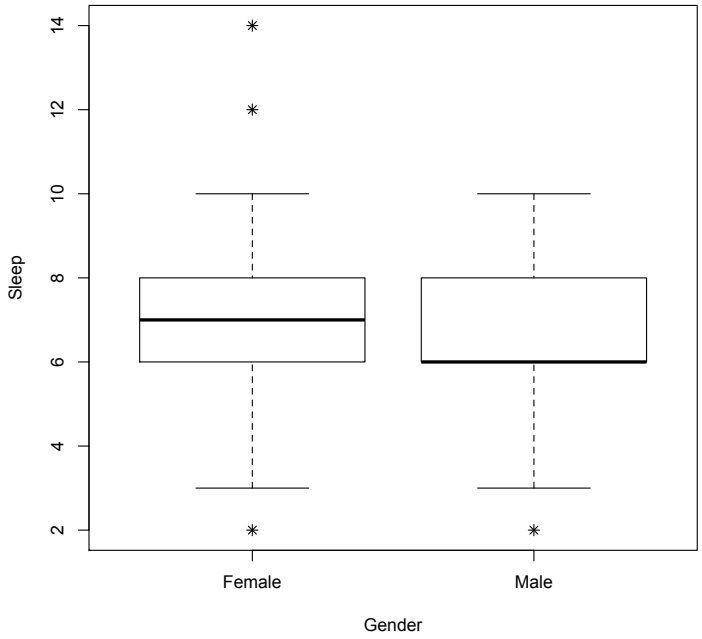
6. Which numerical summary would you choose for these data?

(A) 13.2, 11.7 (B) 10, 11.7 (C) 10, 13.2 (D) 0, 5, 10, 16, 100 (E) 0, 10, 11.7, 100

7. Approximately what percent of the students spent 20 hours or less preparing for class?

(A) 58% (B) 82% (C) 25% (D) 18% (E) 75%

Use the following for the next 2 questions. The Fall 2014 MATH1530 survey asked "Usually, how many hours of sleep do you get a night?" The boxplot and descriptive statistics below summarize the student responses by gender of the number hours of sleep.



Descriptive Statistics: SLEEP

Variable	GENDER	N	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
SLEEP	Female	725	6.62	0.049	1.33	2.0	6.0	7.0	8.0	14.0
	Male	493	6.53	0.060	1.33	2.0	6.0	6.0	8.0	10.0

8. About what percent of the students that are males slept at most 8.0 hours?

   (A) 25%

   (B) 75%

   (C) $8/493 = 1.6\%$

   (D) 50%

   (E) $z = \frac{8.0-6.526}{1.33} = 1.1$ (Area under Normal Curve = 86%)

9. Based on the above information, which of the following descriptions is FALSE?

   (A) The data are skewed right with outliers for both genders.

   (B) The variability in the number of hours slept is the same for both genders.

   (C) The females tended to sleep slightly longer than the males.

   (D) The most number of hours slept in the survey was from a female student.

   (E) There is a strong correlation between male and female sleep habits.

10. The length of the thorax in a population of male fruit flies is approximately Normal with mean 0.800 millimeters (mm) and standard deviation 0.078 mm. What percent of male fruit flies have a thorax length exceeding 0.878 mm? Use the $68-95-99.7$ rule.

    (A) 16% (B) 32% (C) 66% (D) 68% (E) 84%

11. For a biology project, you measure the weight in grams and the tail length in millimeters of a group of mice. Their correlation is $r = 0.7$. If you measured tail length in centimeters instead of millimeters, what would be the correlation? (There are 10 millimeters in a centimeter.)

    (A) $0.7/10 = 0.07$
    (B) $(0.7)(10) = 7$
    (C) $0.7^2 \times 100\% = 49\%$
    (D) 0.7
    (E) Cannot be determined without converting all measurements to centimeters.

12. Does mandatory gun ownership prevent crime? To study this, the number of burglaries committed each month in a small town was recorded for 75 months prior to passage of a bill requiring citizens to own guns and for 56 months after passage of the bill. The goal was to see if the number of burglaries committed was affected by requiring citizens to own guns. The response variable here is

    (A) whether gun ownership is required by law.
    (B) the number of guns owned.
    (C) the number of burglaries committed.
    (D) whether a burglary was committed by a gun owner.
    (E) is number of people in the small town.

13. There is a positive correlation between the size of a hospital (measured by number of beds) and the median number of days that patients remain in the hospital. Does this mean that you can shorten a hospital stay by choosing to go to a small hospital?

    (A) Yes, the data show that stays are shorter in smaller hospitals.
    (B) Yes, the correlation can't be just by an accident.
    (C) No, a negative correlation would allow that conclusion, but this correlation is positive.
    (D) No, this is reverse cause-and-effect.
    (E) No, the positive correlation is probably explained by the fact that seriously ill people go to large hospitals.

14. A marketing class designs two videos advertising a Mercedes sports car. They test the videos by asking fellow students to view both (in random order) and say which makes them more likely to buy the car. Mercedes should be reluctant to agree that the video favored in this study will sell more cars because

    (A) the study used a matched pairs design instead of a completely randomized design.
    (B) results from students may not generalize to the older and richer customers who might buy a Mercedes.
    (C) this is an observational study, not an experiment.
    (D) there is only one factor with two levels.
    (E) correlation does not imply causation.

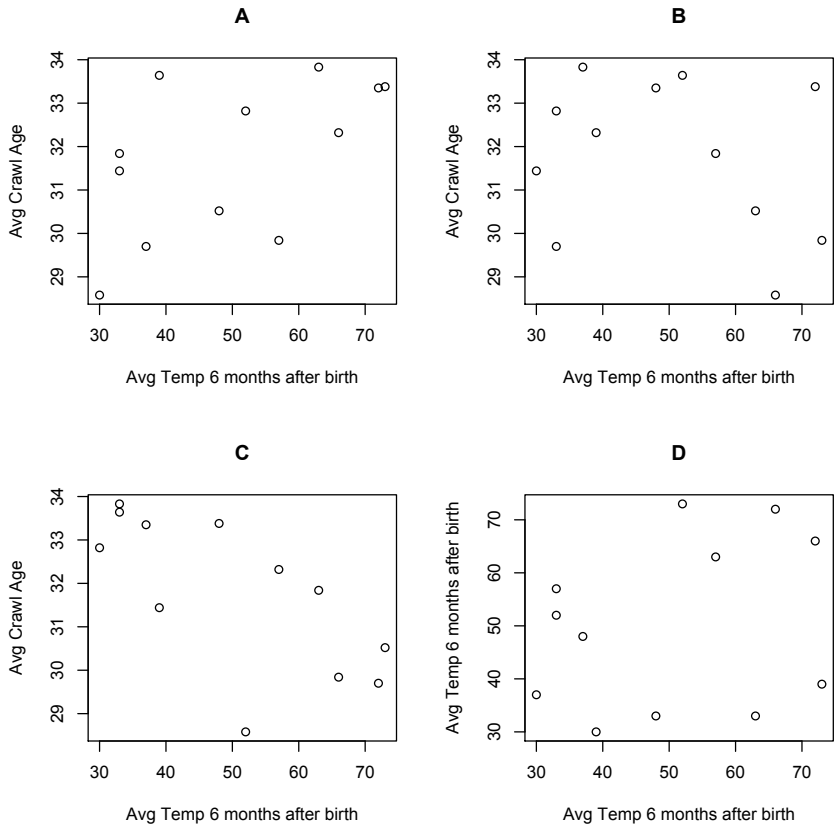
Use the following for the next 5 questions. Babies typically learn to crawl approximately 6 months after birth. However, it may take longer for babies to learn to crawl in the winter when they are often bundled in clothes that restrict their movement. Thus there may be an association between a baby's crawling age and the average temperature during the month they first try to crawl. Below are the average ages (in weeks) at which babies began to crawl for a sample of babies born in each of the twelve months of the year. The average temperature (in degrees F) for the month which is 6 months after the birth month is also listed.

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Avg. Temp 6 mo. after birth	66	73	72	63	52	39	33	30	33	37	48	57
Avg. Crawl Age	29.84	30.52	29.7	31.84	28.58	31.44	33.64	32.82	33.83	33.35	33.38	32.32

15. Using the above data, we can investigate if the average age at which infants begin to crawl is influenced by the average outdoor temperature 6 months after birth when babies are likely to first begin crawling. What is the explanatory variable?

    (A) average age at which infants begin to crawl.
    (B) whether or not the baby is crawling 6 months after birth.
    (C) the average outdoor temperature 6 months after birth.
    (D) the month in which the baby was born.
    (E) The number of babies that were in the study.

16. Which option is a plausible scatterplot of the data?



17. Which of the following statements is true regarding the data?

(A) There is no relation between average age at which infants begin to crawl and the average outdoor temperature 6 months after birth.

(B) There is a negative association between average age at which infants begin to crawl and the average outdoor temperature 6 months after birth.

(C) There is a positive association between average age at which infants begin to crawl and the average outdoor temperature 6 months after birth.

(D) There is a perfect association between average age at which infants begin to crawl and the average outdoor temperature 6 months after birth.

(E) There is a strong curved relationship between average age at which infants begin to crawl and the average outdoor temperature 6 months after birth.

18. Which option is a plausible value for the correlation coefficient between average age at which infants begin to crawl and average outdoor temperature 6 months after birth? (approximately)

(A) $+0.238$ (B) -0.998 (C) $+0.654$ (D) -0.700 (E) 0

19. The equation of the least squares regression line for the data is (approximately)

(A) $\hat{y} = 35.7069 - .0781x$ (C) $\hat{y} = -.0781 + 35.7069x$

(B) $\hat{y} = .0781 - 35.7069x$ (D) $\hat{y} = 35.7069 + .0781x$

(E) $\hat{y} = .0781 + 35.7069x$

20. Inference is _____.

    (A) the process of deducing sample values for populations.

    (B) the process of selecting a sample.

    (C) the process of drawing conclusions about the population from sample information.

    (D) valid for voluntary response samples.

    (E) drawing conclusions about the sample mean and the sample standard deviation.

21. A Gallup poll sponsored by the disposable diaper industry asked, "It is estimated that disposable diapers account for less than 2% of the trash in today's landfills. In contrast, beverage containers, third-class mail and yard waste are estimated to account for about 21% of the trash in landfills. Given this, in your opinion, would it be fair to ban disposable diapers?" 84% responded no. Which type of bias does this poll suffer from?

    (A) Interviewer bias (C) Response bias

    (B) Nonresponse bias (D) Undercoverage bias

    (E) Question wording bias

22. A radio show conducts a phone-in survey each morning. Listeners are asked to call in with a response to the question of the day. One morning in 2011, listeners were asked if they supported or opposed term limits for members of Congress. Remarkably, 88% of listeners that called in favored term limits. We may safely conclude that

    (A) it is unlikely that if all Americans were asked their opinion, the results would differ from that obtained in the poll.

    (B) there is strong evidence that the majority of Americans believe that there should be congressional term limits.

    (C) there is overwhelming approval for congressional term limits among Americans generally.

    (D) there is overwhelming approval for congressional term limits among all people living in the listening area of the radio station.

    (E) nothing, except that a great majority of those with strong enough feelings on the issue to call in are in favor of congressional term limits. We cannot generalize any of this survey's results to any larger population.

23. Asking students about the quality of food available in the cafeteria as they leave is an example of a _____.

    (A) convenience sample (C) stratified random sample

    (B) simple random sample (D) cluster sample

    (E) matched pairs design

24. Two identical looking wrinkle removing creams (called cream A and cream B) were studied. Each of 79 women, aged 50+, put cream A on the side of their face (right or left) determined randomly and the other cream on the other side. Six trained sensory specialists compared before and after photos of each subject to measure the number of removed wrinkles on each side of the face. They did not know which side received which cream. What type of study is this?

    (A) Observational study

    (B) Matched pairs experiment

    (C) Completely randomized experiment

    (D) Stratified random sample

    (E) Two-sample t-test

25. In an observational study, men were asked whether they were currently trying to lose weight. After six weeks, regardless of whether they were trying to lose weight, all men were asked to report their weight loss. The explanatory variable is whether they are currently trying to lose weight. The response variable is the amount of weight lost in six weeks. Which one of the following is NOT a lurking variable that could be confounded with the response variable?

    (A) The average amount of sleep he gets at night.
    (B) Whether he exercises or not.
    (C) Whether he eats "half his plate" in fruits and vegetables.
    (D) Gender
    (E) Age

26. The Fall 2014 MATH 1530 class survey asked "How many devices do you have that will allow you to watch a TV show or movie (live, streaming, pre-recorded, online)?" A distribution of proportions for the number of devices is displayed below. If we randomly select a student who responded to this survey, what is the probability that random student will have at most 2 devices?

Number of devices	0	1	2	3	4	5	6	7	8	9	10 or more
Proportions	0.006	0.086	0.251	0.330	0.185	0.070	0.026	0.007	0.009	0.008	0.022

    (A) 0.092 (B) 0.251 (C) 0.343 (D) 0.657 (E) 0.908

27. **Probabilities in the Pick 3 lottery game.** In Pick 3 the player chooses 3 numbers from 0 to 9. For the straight bet, this is simply matching all 3 numbers in the correct order. The probability of getting each number correct is $1/10$ so the probability of matching all 3 is $(1/10)^3 = 1/1000$. This means that

    (A) since there are only two possibilities (win or lose) your chances of winning will be very close to $50 - 50$ in the long run.
    (B) if you play the Pick 3 lottery thousands of times, the fraction of them that would have a perfect match with your 3 numbers will be very close to $1/1000$.
    (C) if you play the Pick 3 lottery 1000 times, exactly 1 of them will be a perfect match of all 3 numbers.
    (D) if you played the Pick 3 lottery 999 times and lost every time, the next time that you play you should have a perfect match of all 3 numbers.
    (E) if you played the Pick 3 lottery and lost then your chances of winning will increase the next time you play.

28. A North American roulette wheel has 38 slots, of which 18 are red, 18 are black, and 2 are green. Suppose you decide to bet on red on each of 10 consecutive spins of the roulette wheel. Suppose you lose the first 5 wagers. Which of the following is true?

    (A) You are due for a win, so the sixth spin of the wheel is very likely to come up red.
    (B) In the next 5 spins, it will be more likely that the ball will land on red, since it didn't land on red on the first 5 spins.
    (C) The wheel is not working properly. It favors outcomes that are not red. Hence, during the next five spins of the wheel, you're likely to continue to see few red outcomes.
    (D) You have a 5 out of 10 or 50% chance of winning.
    (E) What happened on the first 5 spins tells us nothing about what will happen on the next 5 spins.

Use the following for the next 3 questions. The MATH1530 survey asked students "Do you strongly agree, agree, disagree, or strongly disagree that it is sometimes necessary to discipline a child with a good, hand spanking?" The response may differ for females and males. The distribution of counts is shown in the table.

Discipline	**Female**	**Male**	**Total**
Strongly Agree	280	238	518
Agree	294	187	481
Disagree	90	44	134
Strongly Disagree	56	23	79
Total	720	492	1212

29. What percent of the students strongly agree that it is sometimes necessary to discipline a child with a good, hand spanking?
(A) 23% (B) 39% (C) 43% (D) 54% (E) 59%

30. What percent of females strongly agree that it is sometimes necessary to discipline a child with a good, hand spanking?
(A) 23% (B) 39% (C) 43% (D) 54% (E) 59%

31. What percent of the students who strongly agree that it is sometimes necessary to discipline a child with a good, hand spanking are females?
(A) 23% (B) 39% (C) 43% (D) 54% (E) 59%

Use the following for the next 2 questions. How much sleep do we need? Several sleep studies have found that seven hours is the optimal amount of sleep. The MATH1530 survey asked students "Usually, how many hours sleep do you get a night?" Assume that the 1216 students that responded to this question are an SRS of all students. We suspect that college students sleep less than seven hours. To verify the suspicion, we test the hypotheses

$$H_0 : \mu = 7.0 \; vs. \; H_a : \mu < 7.0$$

We found the following: $\bar{x} = 6.58$ hours, $s = 1.33$ hours, $t = -176$, $p - value \approx 0$. Hence, we reject H_0, and conclude that there is strong evidence that, on average, college students sleep less than seven hours per night.

32. The average number of hours sleep per night was 6.58 hours for this sample of 1216 students. The number 6.58 is a
(A) statistic. (B) parameter. (C) population mean. (D) significant number. (E) practical number.

33. Which of the following would be most helpful in assessing the practical significance of the results?

(A) Test the hypotheses again, using a smaller significance level.

(B) Take a larger sample and retest the hypotheses.

(C) Take a random sample of non-college students and retest the hypotheses.

(D) Plot the data to display the effect we are seeking, and use a confidence interval to estimate the actual value of μ.

(E) Compute the probability of how many students slept less than 7.0 hours.

34. Researchers would like to estimate the mean cholesterol level μ of a particular variety of monkey that is often used in laboratory experiments. They would like their estimate to be within 0.5 milligram per deciliter (mg/dl) of the true value of μ at a 90% confidence level. A previous study involving this variety of monkey suggests that the standard deviation of cholesterol level is about 4.68 mg/dl. What sample size is needed to ensure the margin of error is no more than 0.5 mg/dl at 90% confidence?
(A) 15 (B) 16 (C) 237 (D) 238 (E) 337

35. A medical researcher is working on a new treatment for a certain type of cancer. The average survival time after diagnosis on the standard treatment is one year. In an early trial, she tries the new treatment on four subjects who have an average survival time after diagnosis of three years. Although the survival time has tripled, the results are not statistically significant even at the 0.10 significance level. The explanation is

    (A) the placebo effect is present, which limits statistical significance.

    (B) the sample size is small.

    (C) that although the survival time has doubled, in reality the actual increase is really two years.

    (D) the calculation was in error. The researchers forgot to include the sample size.

    (E) the results are not of practical importance.

36. In a large population of college-educated adults, the mean IQ score is 112 with standard deviation of 25. Suppose 300 adults from this population are randomly selected for a market research campaign. The distribution of the sample mean IQ is

    (A) approximately Normal, mean 112, standard deviation 25.

    (B) approximately Normal, mean 112, standard deviation 0.083.

    (C) approximately Normal, mean 112, standard deviation 1.443.

    (D) approximately Normal, mean equal to the observed value of the sample mean, standard deviation 25

    (E) Cannot determine based on the information provided.

37. People theorize that getting married makes people more responsible. That's part of the reason married individuals have lower automobile insurance rates. Do married people also earn more? We plan to take random samples of 100 married and 100 single people, and ask them their incomes. The hypotheses of interest are

    (A) $H_0 : \mu_{married} = \mu_{single}$ vs. $H_a : \mu_{married} > \mu_{single}$

    (B) $H_0 : \mu_{married} = \mu_{single}$ vs. $H_a : \mu_{married} \neq \mu_{single}$

    (C) $H_0 : \mu_{married} = \mu_{single}$ vs. $H_a : \mu_{married} < \mu_{single}$.

    (D) $H_0 : \mu_d$ vs. $H_a : \mu_d > 0$.

    (E) $H_0 : \bar{X}_{married} > \bar{X}_{single}$ vs. $H_a : \bar{X}_{married} < \bar{X}_{single}$

38. The Fall 2014 MATH1530 survey asked students "Should Tennessee implement a state income tax?" In the sample of 1184 students who responded to this question, 864 said "NO." The sample proportion $\hat{p}$ from this sample is _____.

    (A) 1184 (B) 864 (C) 1.96 (D) 1.37 (E) 0.730

39. In a random sample of 500 college students, 78% said they were worried about their ability to find a job when they graduate because of the current economy. Based on this sample, we can say with 95% confidence that between _____ and _____ of all college students are worried about their ability to find a job when they graduate.

    (A) 74.4% 81.6% (B) 78% 95% (C) 390 475 (D) $78\% \pm 2\%$ (E) 0 500

40. When we conduct a hypothesis test, we assume something is true and calculate the probability of observing the sample data under this assumption. What do we assume is true?

    (A) P-value (B) Alpha (C) $\bar{X}$ and σ (D) Null hypothesis (E) Alternative hypothesis

41. A marketing analyst for a cable provider wishes to know if males or females watch more TV in order for the company's advertisements to target that specific gender. After talking to the company's current sales representatives across the US, he concludes that males watch more TV. Question 9 from the MATH 1530 survey asked students "How many hours do you personally watch television including Netflix, Hulu Plus, Amazon Prime, etc... in a day?" Assume that the students who responded to the survey are a SRS of all ETSU students. A 95% confidence interval for the difference in the mean number of hours of TV watched between male and female students is $(-0.255, 0.210)$. What does this mean?

    (A) 95% of all the number of hours of TV lies between -0.255 and 0.210.

    (B) We are 95% confident that the true mean difference in the number of hours of TV watched in a day between female and male students is between -0.255 and 0.210 hours.

    (C) A confidence interval between -0.255 and 0.210 means that the difference in populations means definitely lies between -0.255 and 0.210.

    (D) There is strong evidence to indicate that there is a difference in the mean number of hours of TV watched between male and female students.

    (E) We are 95% confident that $\bar{X}_{male} - \bar{X}_{female}$ lies between -0.255 and 0.210.

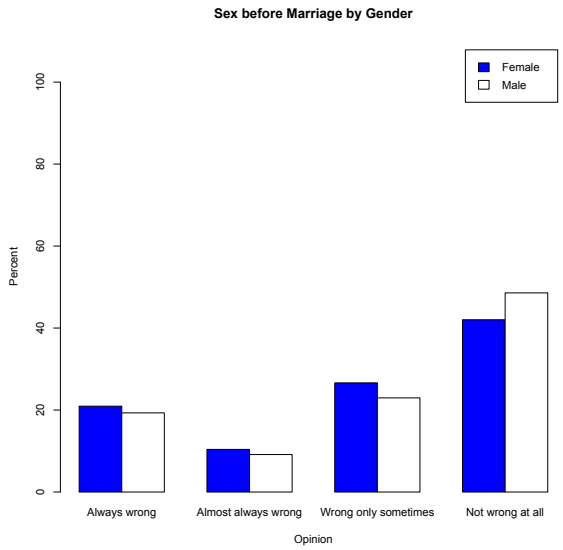
42. A department of labor researcher wants to determine if there is a dependence between an individual's ethnicity and the type of industry they work in. Which statistical method is most applicable?

    (A) One sample proportion test (C) Confidence interval for difference in means

    (B) Chi-square test (D) Histogram

    (E) Two-sample t statistic

43. How do male students and female students differ in their responses to the survey question "There's been a lot of discussion about the way morals and attitudes about sex are changing in this country. What is your opinion about two people having sexual relations before marriage?" Here is the summary analysis of the survey results:

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Pearson Chi-Square = 5.2211, DF = 3, P-Value = 0.156
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Which of the following is the best conclusion?

(A) Reject H_0 and conclude that there is a strong association between gender and sex before marriage.

(B) Do not reject H_0 and conclude that male students and female students have a different view about sex before marriage.

(C) Male students and female students have very similar views about two people having sexual relations before marriage.

(D) There is strong evidence to suggest that male students and female students have different views of sex before marriage.

(E) The distributions are both slightly skewed left with no outliers. Hence, the analysis is appropriate and also significant.