Math 1530 Final Exam
May 2010

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 may use a calculator but a calculator manual cannot be used.

FORM A

Use the following for the next 2 questions. A random sample of 110 women who were tested for cholesterol and were classified according to age and cholesterol level. The Minitab output shows the two-way table and related information.

Tabulated statistics: Age, Cholesterol Level
Using frequencies in Counts

Rows: Age	Columns: Cholesterol Level			
	< 180	$180 - 210$	> 210	All
< 50	15	21	19	55
	14.50	17.00	23.50	55.00
≥ 50	14	13	28	55
	14.50	17.00	23.50	55.00
All	29	34	47	110
	29.00	34.00	47.00	110.00

Cell Contents: Count
Expected Count

Pearson Chi-Square = 3.640, DF = 2, P-Value = 0.162

1. The null hypothesis for the chi-square test for this two-way table is

   (A) The observed counts will be different from the expected counts.
   (B) There is no difference between the two age groups in their distributions of cholesterol levels.
   (C) The marginal distribution of the levels of cholesterol are all the same.
   (D) The percentage that fall into each cell (total of 6) are all identical.
   (E) The counts that fall into each cell are all identical.

2. What is the correct conclusion of this analysis? (Use $\alpha = 0.05$.)

   (A) There does appear to be a difference between the two age groups in their distributions of cholesterol levels.
   (B) The marginal distributions for the two age groups are both 55 which implies no difference.
   (C) There doesn't appear to be any difference between the two age groups in their distributions of cholesterol levels.
   (D) The percentage of females that fall into each of the levels of cholesterol are all different.
   (E) The percentage that fall into each cell are all different.

3. In attempting to control the strength of the wastes discharged into a nearby river, a paper firm has taken a number of measures. Members of the firm believe that they have reduced the oxygen-consuming power of their wastes from mean μ of 500 (measured in permanganate in parts per million). They plan to test $H_0 : \mu = 500\, vs.\, H_a : \mu < 500$, using readings taken on $n = 25$ consecutive days. Treat these 25 values as a random sample. Which of the following is the correct conclusion based on the analysis? (Use $\alpha = 0.01$.)

```
One-Sample T
Test of mu = 500 vs < 500
                              95% Upper
 N   Mean  StDev  SE Mean      Bound      T      P
25  308.8  115.2     23.0      348.2  -8.30  0.000
```

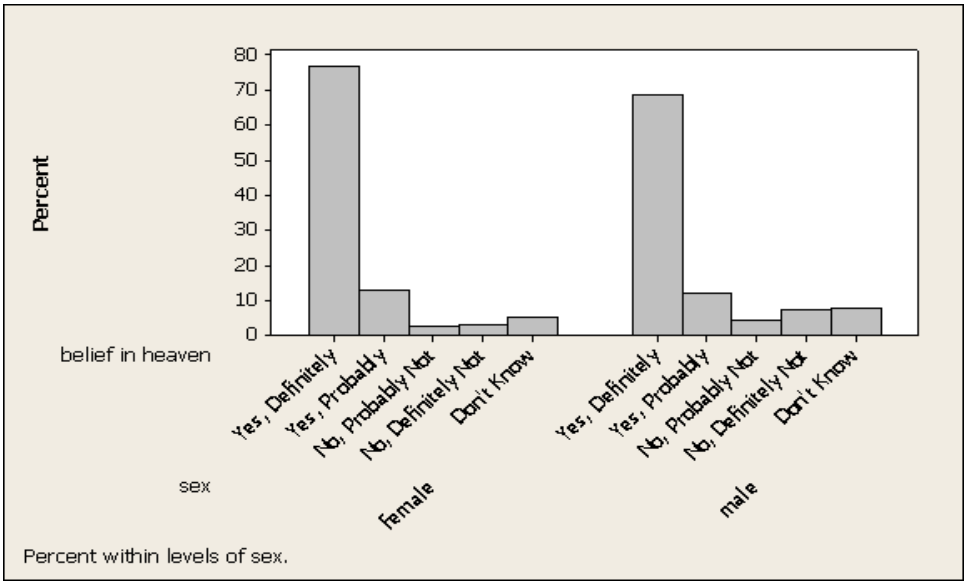
   (A) Do not reject H_0 since the p-value = 0.000.
   (B) There seems to be strong evidence to suggest that the paper firm has reduced the oxygen-consuming power of their wastes from mean μ of 500 parts per million of permanganates.
   (C) Reject H_0 and conclude that the firm has not reduced the mean wastes from 500 parts per million of permanganates.
   (D) There does not seem to be strong evidence to suggest that the paper firm has reduced the oxygen-consuming power of their wastes from mean μ of 500 parts per million of permanganates.
   (E) The results are inconclusive since the 95% confidence interval is at most 348.2 and this is less than 500.

4. Which of these questions from the class survey produced variables that are categorical?

   i. What is your sex (m = male, f = female)?
   ii. Have you used any tobacco products in the past 30 days? (1=Yes, 0=No)
   iii. What is your height in inches?
   iv. How many hours did you sleep last night?
   v. What is your favorite genre of film?
   vi. What's the fastest you've ever driven a car?

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

Use the following for the next 2 questions. The figure below represents the conditional distributions of belief in heaven given sex.



5. Approximately what percent of the females responded "Yes, Definitely or Yes, Probably" on the belief of heaven?
   (A) About 90% (B) About 75% (C) About 80% (D) 75% $\pm$ 10% (E) Unable to determine from the figure.

6. Which of the following is a true statement?

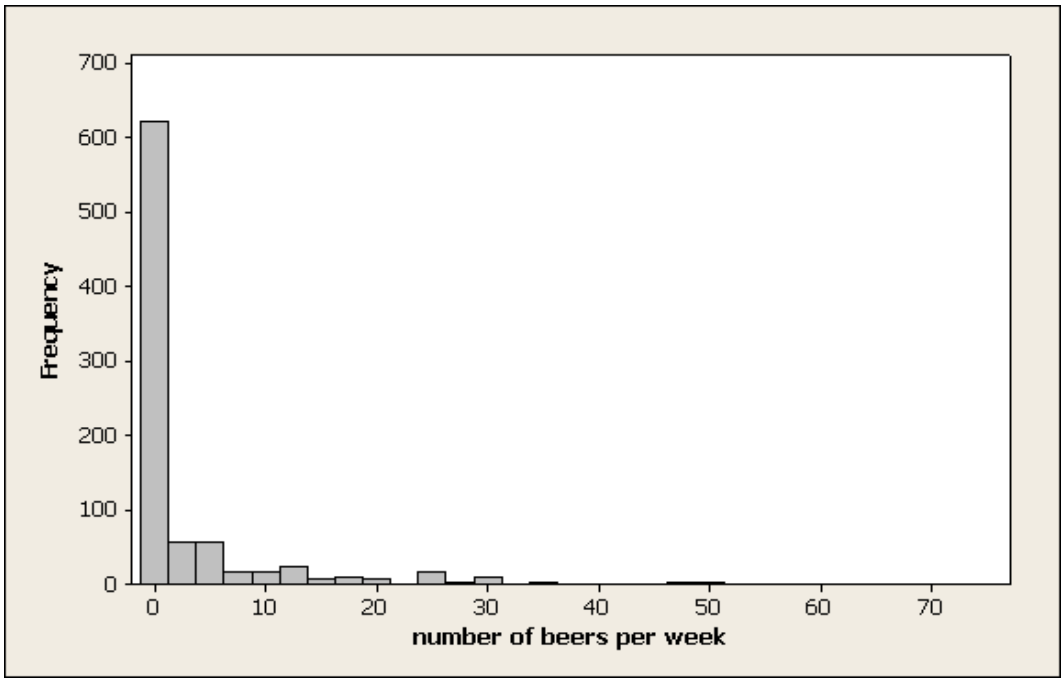
   (A) The bar graphs are bimodal.
   (B) The bar graphs are skewed to the left.
   (C) It appears that both graphs are skewed right with centers around 'No, Probably Not.'
   (D) The bar graphs are skewed to the right so the mean would be larger than the median and the spread ranges from 'Yes, Definitely' to 'Don't Know.'
   (E) Overall, it appears that the females may have a stronger belief in heaven than the males.

7. Ali H. Mokdad, Ph.D., and colleagues from the Centers for Disease Control and Prevention, Atlanta, conducted a study to identify and quantify the leading causes of death in the United States. The study included a comprehensive MEDLINE search of English-language articles that identified epidemiological, clinical and laboratory studies linking risk behaviors and mortality (death). The researchers used 2000 mortality data reported to the Centers for Disease Control and Prevention to identify the causes and number of deaths. The leading causes of death in 2000 are given below. Which type of graph is appropriate for these data?

Leading Causes of Death	Counts
Tobacco	435,000
Poor Diet & Physical Inactivity	400,000
Alcohol Consumption	85,000
Microbial Agents	75,000
Toxic Agents	55,000
Motor Vehicle Crashes	43,000
Incidents Involving Firearms	29,000
Sexual Behaviors	20,000
Illicit Use of Drugs	17,000

(A) histogram (B) stem plot (C) scatterplot (D) boxplot (E) bar chart

Use the following for the next 3 questions. The histogram and descriptive statistics below summarize the student responses from the class survey to the question "How many beers per week do you typically consume?"

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Descriptive Statistics: number of beers per week

Variable                    N    Mean  SE Mean  StDev  Minimum     Q1   Median     Q3   Maximum
number of beers per week  858   3.202    0.267  7.825    0.000  0.000    0.000  2.000    75.000
```

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

(A) 10 beers $\pm$3 beers

(B) The data seems to be somewhat symmetric.

(C) There is an outlier and it is 70.

(D) The data are strongly skewed right with many outliers.

(E) Who: 859 students, What: number of beers per week

9. About what percent of the students have at least 2 beers per week?
   (A) 75% (B) 50% (C) 50/858 or 5.8% (D) $z = \frac{2-3.202}{7.825} = -.15$ (Area = 56%) (E) 25%

10. What if we found out that there was a data entry mistake and the 75 (maximum value) should have been a 25, how would the above descriptive statistics change if we could rerun Minitab using the data value 25 in place of the 75?

	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
(A)	3.202	0.267	7.825	0	0	0	2	less than 75
(B)	3.202/3=1.07	0.267/3=.089	7.825/3=2.61	0/3=0	0/3=0	0/3=0	2/3=.67	75/3=25
(C)	less than 3.202	less than 0.267	less than 7.825	0	0	0	2	less than 75
(D)	less than 3.202	less than 0.267	less than 7.825	less than 0	less than 0	less than 0	less than 2	less than 75
(E)	No idea without actually running Minitab again.							

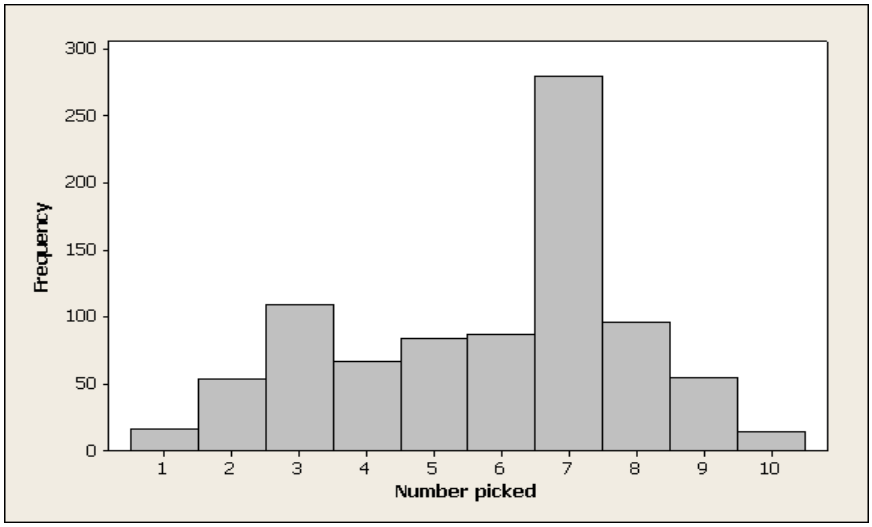
Use the following for the next 2 questions. From the class survey a sample of 9 students who responded to "How many hours did you sleep last night?" was taken. The data are

8 6 5 7 8 8 6 7 7

11. What is the median value of this data?
    (A) 6.9 (B) 7 (C) 8 (D) 7.5 (E) 8.5

12. What is the mean value of this data?
    (A) 7 (B) 8 (C) 7.5 (D) 8.5 (E) 6.9

13. From the class survey students were asked to "Randomly pick a number between 1 and 10." The figure below illustrates the results from this survey question. Are we good randomizers?



(A) The distribution is somewhat symmetric about the number 5.

(B) The distribution is skewed right with a center of about 5.

(C) It doesn't appear that we are good randomizers. If we were good randomizers we should see a more uniform (flat) distribution across the 10 numbers. We see that the number 7 is picked the most!

(D) It appears that we are good randomizers since all numbers were chosen.

(E) The distribution should be more bell-shaped with a center of 5 and standard deviation of 2 to satisfy the 68-95-99.7 percent rule.

14. Would it be more desirable for variability to be high or low for each of the following cases? (a) The amount of rainfall in this area from year to year, (b) Fuel efficiency(mpg) (all the same make and model) of new cars coming off one production line, (c) Daily sugar levels of a diabetic person, (d) Age of trees in a national forest.

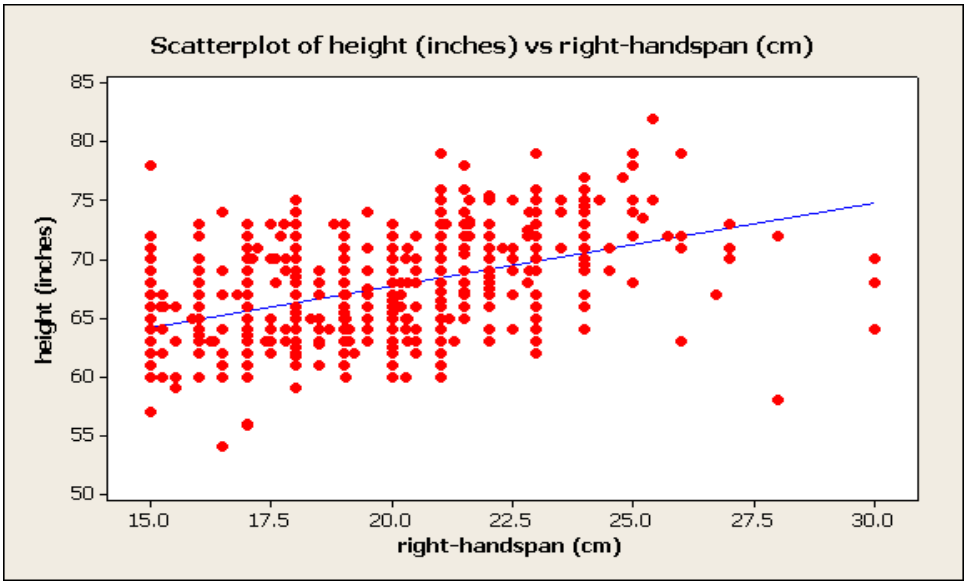
    (A) high variability: a; low variability: b,c,d
    (B) high variability: a,d; low variability: b,c
    (C) high variability: d; low variability: a,b,c
    (D) high variability: b,c,d; low variability: a
    (E) high variability: c; low variability: a,b,d

15. A newspaper conducts a survey of college students and finds a positive association between their heights and their responses to the question "What is the fastest you have ever driven a car?" The newspaper headline reports "Height and Lead Foot Go Together." Is this a sensible conclusion?

    (A) Yes, height is causing the lead foot.
    (B) Not necessarily. We know that men tend to be taller than women and studies indicate that men tend to claim a higher faster speed than women do. One should examine the relationship separately for men and women.
    (C) Yes, the bigger you are the more pressure you will apply to the accelerator.
    (D) No, the size of one's foot is the lurking variable here.
    (E) No, unless r was close to 1 then there is strong evidence to suggest knowing someone's height would give us an idea how fast they would likely drive.

Use the following for the next 3 questions. Can we predict the height (in inches) of a student by knowing their right handspan (in cm)? The observations and least-squares regression line appear in the scatterplot. The correlation between the two variables is $r = 0.471$ and the least-squares regression line for predicting the *Height* (inches) of a student from their *Right-Handspan* (centimeters) is

$$\texttt{Height} = 53.54 + 0.7089 \times \texttt{Right-Handspan}.$$



16. Which of the following best describes the relationship between right handspan and height?

    (A) There seems to be a negative linear relationship between right handspan and height with possible outliers.
    (B) The association is very weak since the points on the scatterplot do not all fall on a line.
    (C) There seems to be a positive linear relationship between right handspan and height with possible outliers.
    (D) It does not make any sense to fit a regression model since right handspan is measured in centimeters and height is measured in inches.
    (E) Since $r = 0.471$ we know that for every centimeter increase in right handspan we will know exactly the height of the individual.

17. Which of the following is the correct interpretation of the slope of the regression equation?

    (A) Since the correlation is 0.471, height increases by about 47.1% on the average.
    (B) For every centimeter increase in right handspan, height increases by 0.7089 inches on the average.
    (C) Height increases by about 0.7089 inches on the average.
    (D) As height increases, the right handspan increases by about 0.7089 centimeters on the average.
    (E) For every centimeter increase in right handspan, height increases by 53.54 inches on the average.

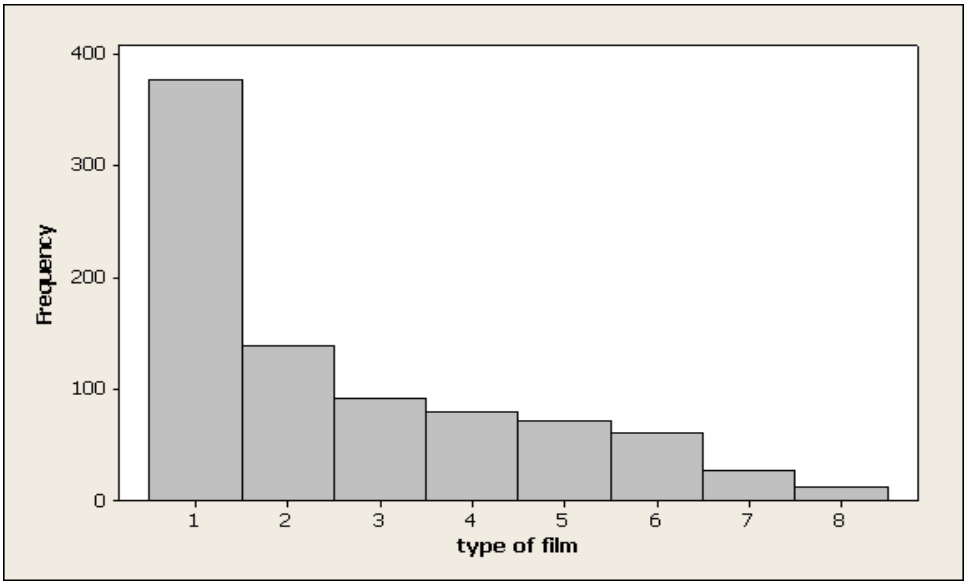
18. Use the regression equation to predict the height of a student whose right handspan is 22.5 cm.

    (A) $0.471 \times 22.5 + 53.54 = 64.14$ in.
    (B) $0.7089 \times 22.5 = 15.95$ cm.
    (C) $53.54 + 0.7089 \times 22.5 = 69.5$ in.
    (D) $53.54 + 0.7089 = 54.25$ in.
    (E) Any value between 60 and 80 inches.

19. An analyst for the movie industry has been assigned to analyze the type of films that college students like. The type of film had been coded for easy data entry and the values are shown in the table below.

Movie Type	Comedy	Action	Horror	Romance	Drama	Sci-Fi	Other	Children
Codes	1	2	3	4	5	6	7	8

The analyst produces the following figure of the movie type codes from a large sample of college students.



They are interested in the interpretation of this plot. Which of the following is the best interpretation of this plot?

    (A) Students prefer comedies more than 2 times greater than any other types of movies.
    (B) The distribution is strongly skewed right and the five-number summary should be used to describe this data numerically.
    (C) The median is around 4 and the spread goes from 1 to 8.
    (D) The mean will be larger than the median since the data are right skewed.
    (E) Since the data are not bell-shaped we must be careful in applying the 68-95-99.7 percent rule.

Use the following to answer the next 3 questions about gender and tobacco use. The class survey asked for gender type and "Have you used any tobacco products in the past 30 days?" The distribution of counts is shown below in the table. Choose a student at random from this group.

Tabulated statistics: Gender, Tobacco Use

Rows: Gender Columns: Tobacco Use

	Yes	No	All
Female	109	392	501
Male	149	215	364
All	258	607	865

Cell Contents: Count

20. The probability that the student is a male and has used tobacco products in the past 30 days is
(A) .1723 (B) .4208 (C) .4093 (D) .5775 (E) .2983

21. The conditional probability that the student was male, given that the student used tobacco products in the past 30 days, is about
(A) .4093 (B) .1723 (C) .4208 (D) .5775 (E) .2983

22. The conditional probability that the student used tobacco products in the past 30 days, given that the student was a male, is about
(A) .4093 (B) .5775 (C) .1723 (D) .2983 (E) .4208

23. A call-in poll at WETS-FM was conducted to gauge the new format – more news and less music. At the end of the program, the anchor announced that 61% of callers were opposed to the new format with a margin of error $\pm 5\%$. This conclusion was based on data collected from 450 calls made by local listeners. The sampling technique being used is
(A) A voluntary response sample. (C) A census.
(B) A simple random sampling. (D) A stratified random sample.
(E) An unbiased random sample.

24. The Gallup Poll conducted a representative telephone survey of 1180 American voters during the first quarter of 2010. Among the reported results were the voter's region (Northeast, South, etc.), age, party affiliation, and whether or not the person had voted in the 2008 midterm Congressional election. Who are the individuals in this survey?
(A) Region, age, political affiliation, and whether or not the person voted in the 2008 midterm Congressional election.
(B) The Gallup Poll
(C) The first quarter of 2010
(D) The list of all telephone numbers
(E) The 1180 Americans surveyed

25. Police trainees were seated in a darkened room facing a projector screen. Ten different license plates were projected on the screen, one at a time, for 5 seconds each, separated by 15-second intervals. After the last 15-second interval, the lights were turned on and the police trainees were asked to write down as many of the 10 license plate numbers as possible, in any order at all. A random sample of 15 trainees who took this test were then given a week-long memory training course. They were then retested. This is
(A) a completely randomized experiment. (C) a stratified random sample.
(B) a matched pairs experiment. (D) an observational study.
(E) an uncontrolled study.

26. Suppose we want to study the effect of smoking on lung capacity in women. Here are two ways to study this question.

    (1) Find 100 women age 20 who do not currently smoke. Randomly assign 50 of the 100 women to the smoking treatment and the other 50 to the no smoking treatment. Those in the smoking group smoke a pack a day for 10 years while those in the control group remain smoke free for 10 years. Measure lung capacity for each of the 100 women.

    (2) Find 100 women age 30 of which 50 have been smoking a pack a day for 10 years while the other 50 have been smoke free for 10 years. Measure lung capacity for each of the 100 women.

    Which of the following is correct?

    (A) Both designs are experiments.

    (B) The first design is an experiment, and the second is an observational study.

    (C) The first design is an observational study, and the second is an experiment.

    (D) Both designs are observational studies.

    (E) The first design is a stratified random sample and the second is an SRS.

    Use the following for the next 2 questions. Suppose we are interested in about the sleep habits of ETSU students. We read that doctors recommend eight hours of sleep for an average adult. What proportion of ETSU students get at least eight hours of sleep? A random sample of 49 students was selected from the class survey and the number of hours slept is recorded below.

8.0	7.0	6.0	7.0	9.5	9.0	6.0	8.0	7.0	6.0	10.0	4.5	10.0
8.0	8.5	7.0	10.0	7.0	8.5	8.5	4.0	5.0	8.0	8.0	9.0	7.0
6.0	5.0	6.0	7.0	6.0	9.5	7.0	6.0	8.0	7.0	8.0	7.0	6.0
7.0	8.0	7.0	7.0	8.0	6.0	8.0	9.0	6.0	7.0			

27. Based on these data, a 95% confidence interval for p, the proportion of all ETSU students that get at least eight hours of sleep, is

    (A) 6.898 to 7.714 hours (B) 7.3 ± 2 hours (C) 10% to 34% (D) 0.290 to 0.567 (E) 0.43 to 0.71

28. You want to estimate the proportion p of ETSU students that get at least eight hours of sleep with 95% confidence and a margin of error no greater than 3%, or 0.03. How large a sample do you need? You can use the guess $p^* = 0.5$.

    (A) $n = 1068$ (B) $n = 49$ (C) $n = 256$ (D) $n = 2124$ (E) $n = 98$

    Use the following for the next 2 questions. A local grocery store received many customer complaints about the quantity of chips in 16-ounce bags of a particular brand. Wanting to assure its customers they were getting their money's worth, the store decided to test the hypotheses concerning the true average weight (in ounces) of a bag of such potato chips in the next shipment received from the supplier.

29. The hypotheses for a test to answer this question are

    (A) $H_0 : \mu = 16, H_a : \mu > 16$ (C) $H_0 : p = 16, H_a : p < 16$

    (B) $H_0 : \bar{x} = 16, H_a : \bar{x} < 16$ (D) $H_0 := 16,\ H_a :\neq 16$

    (E) $H_0 : \mu = 16, H_a : \mu < 16$

30. If there is evidence in favor of the alternative hypothesis, the shipment will be refused and a complaint registered with the supplier. Some bags of chips were selected from the next shipment and the weight of each selected bag was measured. The researcher for the supermarket chain stated that the data were statistically significant. What does "statistically significant" mean in this context?

    (A) Perhaps the results are attributable to some confounding variable (e.g., color of the bag).

    (B) The researcher found evidence to suggest that the true average weight is under 16 ounces.

    (C) The results are of practical importance and this can be stated with 95% confidence.

    (D) The chance that the null hypothesis is true is very small.

    (E) The researcher found no evidence to suggest that the mean weight of the bag of chips is less than 16 ounces.

Use the following for the next 4 questions. Experience with a certain type of plastic indicates that a relation exists between the hardness (measures in Brinell units) of items molded from the plastic and the elapsed time since termination of the molding process. Here are data from such an experiment:

Elapsed Time (hrs.)	Hardness in Brinell units			
16	199	205	196	200
24	218	220	215	223
32	237	234	235	230
40	250	248	253	246

31. This experiment has

(A) sixteen factors.
(B) sixteen plastics being compared.
(C) two factors, elapsed time and hardness.
(D) a stratified random sample design.
(E) one factor with four levels of elapsed time.

32. Sixteen batches of the plastic were made, and from each batch one test item was molded. Each test item was randomly assigned to one of the four predetermined time levels, and the hardness was measured after the assigned elapsed time. This is a

(A) block design, with four blocks.
(B) matched pairs design.
(C) controlled observational study.
(D) stratified random sample.
(E) completely randomized design.

33. An important response variable in this experiment is

(A) 16 plastics.
(B) 16, 24, 32, or 40 hours.
(C) whether or not the plastics were molded or not.
(D) hardness in Brinell units.
(E) the double-blind process.

34. Describe the overall pattern of the relationship between elapsed time and hardness.

(A) There is a negative linear association between elapsed time and hardness.
(B) For every 8 hour increase in elapsed time, hardness increases 10 Brinell units.
(C) As elapsed time increases the hardness decreases.
(D) There is a positive linear association between elapsed time and hardness.
(E) A linear association is not appropriate because elapsed time only takes on 4 values.

35. An engineer designs an improved automobile engine for a certain make of automobile. The previous design had an average highway gas mileage of 30 mpg (miles per gallon). The new engine has an average highway gas mileage of 30.2 mpg, based on a sample of 3600 cars of the model with the new engine. Although the difference is quite small, the effect is statistically significant. The explanation is

(A) that new designs typically have less variability than standard designs, and so small differences can appear to be statistically significant.
(B) it is based on a very large sample.
(C) the p-value is large.
(D) that the mean of 30.2 is large compared to the gas mileage of most cars.
(E) the size of the sample doesn't have any effect on the significance of the test.

36. The council of a municipality wanted to determine the opinion of residents about the installation of the traffic cameras installed at the corner of a dangerous intersection. They use the telephone book to randomly select 5000 residential addresses of the city and mail a survey to the selected sample. After two weeks the completed surveys were returned and the results of the survey were revealed. Of the 1500 returned surveys they found 75% were against the traffic cameras stating it was an invasion of privacy. The city council also reported the margin of error was $\pm 3\%$. How should we interpret these results?

    (A) The results of the survey should not be trusted since it suffers from undercoverage and nonresponse.

    (B) The numbers don't add up since it appears that only 1125 citizens were against the traffic cameras. So it appears that the rest of the population is for the traffic cameras.

    (C) We are 95% confident that the percentage of all the citizens that oppose the traffic cameras lies between 72% and 78%.

    (D) The margin of error tells us that all sources of error (sampling variability, nonresponse and undercoverage) are covered and it appears that a strong majority of the citizens oppose the traffic cameras.

    (E) The sample size from the phone book should have been larger to decrease the margin of error.

37. Suppose two researchers wanted to determine if aspirin reduced the chance of a heart attack. Researcher 1 studied the medical records of 500 patients. For each patient, he recorded whether the person took aspirin every day and if the person had ever had a heart attack. Then he reported the percentage of heart attacks for the patients who took aspirin every day and for those who did not take aspirin every day. Researcher 2 also studied 500 people. He randomly assigned half (250) of the patients to take aspirin every day and the other half to take a placebo everyday then after a certain length of time he reported the percentage of heart attacks for the patients who took aspirin every day and for those who did not take aspirin every day. Suppose that both researchers found that there is a statistically significant difference in the heart attack rates for the aspirin users and the non-aspirin users and that aspirin users had a lower rate of heart attacks. Can both researchers conclude that aspirin helps reduce the chance of a heart attack?

    (A) Yes, because aspirin users had a lower heart attack rate in both studies.

    (B) Yes, because aspirin is known to reduce heart attacks.

    (C) No, only researcher 1 can conclude this since this is an observational study.

    (D) No, only researcher 2 can conclude this since this is a randomized comparative experiment.

    (E) No, neither can conclude this because diet and lifestyle are lurking variables.

38. A fair coin is tossed, and you win a dollar if there are more than 60% heads. Which of the following is better?

    (A) 10 tosses would be better than 100 tosses because the law of large numbers tells us as the number of tosses goes up, the percentage of heads is likely to be closer to 50%.

    (B) 100 tosses would be better than 10 tosses because the law of large numbers tells us as the number of tosses goes up, the percentage of heads is likely to be closer to 50%.

    (C) Whether the coin is tossed 10 times or 100 times your chance of winning \$1 would be the same.

    (D) We should require the number of tosses to be at least 1000.

    (E) There is a 50% chance that you win a dollar if there are more than 60% heads on any number of tosses.

39. The Mayo Clinic reports the following: "The amount of sleep you need depends on many factors, especially your age. Infants typically sleep at least 16 hours a day. Most preschoolers need at least 11 hours of sleep a night, and most school-age children need at least 10 hours of sleep a night. By the teenage years, nine hours of sleep a night is usually adequate. For most adults, seven to eight hours a night seems about right." The Math 1530 survey revealed that the average number of hours slept for 861 students was about 6.8 hours. If we consider the 861 students who responded to the survey question as a random sample of all students at ETSU, which of the following would be most helpful in assessing the practical significance of a test of hypotheses $H_0 : \mu = 7$ $H_a : \mu \neq 7$?

    (A) Take another sample and retest just to make sure the results are not due to chance.

    (B) A statistically significant result.

    (C) A 95% confidence interval for the mean number of hours slept is $(6.6714, 6.9044)$.

    (D) Test the hypotheses using significance level $\alpha = 0.001$.

    (E) Increase the sample size so that the P-value will be even smaller and the results will be more statistically significant.

40. The amount of money college students spend each semester on textbooks is normally distributed with a mean of \$195 and a standard deviation of \$20. Suppose you take a random sample of 100 college students from this population. There would be a 95% chance that the sample mean ($\bar{X}$) amount spent on textbooks would be between:

    (A) \$193 and \$197. (B) \$175 and \$215. (C) \$155 and \$235. (D) \$191 and \$199. (E) $\$195 \pm (.68)(20/\sqrt{100})$

41. A Gallup Poll asked 1,523 adult respondents and also 501 teens (ages 13 to 17) whether they generally approved of legal gambling: 63% of adults and 52% of teens said yes. The margin of error for a 95% confidence statement about adults would be

    (A) greater than the margin of error for a 95% confidence statement about teens because the sample is larger.

    (B) smaller than the margin of error for a 95% confidence statement about teens because the sample is larger.

    (C) less than for teens, because there are fewer teens in the population.

    (D) the same as for teens, because they both come from the same sample survey.

    (E) Can't say, because it depends on what percent of each population was in the sample.

42. Joe Stats is writing a report on the backgrounds of American presidents. He looks up the ages of all 44 presidents when they entered office. He finds that the mean age of the presidents is 54.7 years with the standard deviation of 6.20 years. He calculates a 95% confidence interval for the mean age of all men who have been president to be 54.7 ± 1.83. Comment on this result.

    (A) Joe Stats can be 95% confident that the mean age of all presidents is 54.7 years.

    (B) 95% of all the ages of the presidents lie between 54.7 ± 1.83.

    (C) Joe Stats is 95% confident that the mean age of all presidents lies between 52.87 and 56.53 years.

    (D) Joe Stats should have taken a larger sample to reduce the margin of error.

    (E) The confidence interval makes no sense since Joe Stats has the entire population of ages.