PRACTICE TEST 2 Math 15 STATISTICS Jones Spring 2020 Name________________________________

Show all work! Draw a normal distribution when needed.

Answer the question.

1) Suppose that computer literacy among people ages 40 and older is being studied and that the accompanying tabl describes the probability distribution for four randomly selected people, where x is the number that are compute literate.

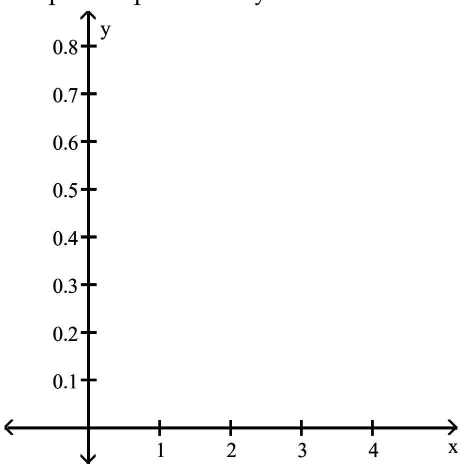
a) is this a probability distribution________

x	P(x)
0	0.16
1	0.25
2	0.36
3	0.15
4	0.08

Is it unusual to find four computer literates among four randomly selected people? (WHY?)

What is the probability of getting 2 or fewer people out of the 4 who are computer literate?__________

Graph this probabillity distribution.



Find the mean of this probability distribution.

Find the Standard deviation of this distribution.

2) Suppose you buy 1 ticket for $1 out of a lottery of 1,000 tickets where the prize for the one winning ticket is to be $500. What is your expected value?

Solve the problem.

3) Suppose that replacement times for washing machines are normally distributed with a mean of 9.3 years and a standard deviation of 2 years.

a) Draw this distribution showing an axes for the age of the machine and a z–axes.

b) What proportion of washing machines last more than 10 years?

c) If a store sells 100 washers how many do they expect to last more than 5 years?

d) Find the replacement time that separates the top 18% from the bottom 82%.

e) If you sell 9 washing machines.
What is the probability that the mean life ot the 9 machines is more than 10 years?

Then use the Binomial Theorem to find the probability exactly.

4) An engineer thinks that she had improved the quality of the circuit boards that she is designing. The defect rate has been 14%. But in the last sample of 50 parts she found that only 4 were defective. Is this conclusive proof that she improved her design or is this sample usual to see when the defect rate is 14% and more data needed to be sure that the defect rate really has decreased. Assume that many thousands of parts are being produced.

a) What is the mean and standard deviation of the binomial distribution used for this problem.

b) How many do we expect to be defective?

c) What is the proability that we see a sample with at most 4 when the defect rate is 14%?
Use the binomial Distribution.

d) Does this sample verify her claim that the defect rate has been lowered?

Find the indicated probability. Show graphs with both x and z axis.

5) A bank's loan officer rates applicants for credit. The ratings are normally distributed with a mean of 200 and a sta deviation of 50.

a) If an applicant is randomly selected, find the probability of a rating that is between 200 and 275.

b) In todays market the loan officer is only giving loans to the top 30% of applicates. What rating will separate th 30% of applicants from the bottom 70%.

Solve the problem. Graph of the distribution of sample means is required.

6) A bank's loan officer rates applicants for credit. The ratings are normally distributed with a mean of 200 and a sta deviation of 50.
If 40 different applicants are randomly selected, find the probability that their mean score is above 215.

7) The diameters of pencils produced by a certain machine are normally distributed with a mean of 0.30 inches and a standard deviation of 0.01 inches. In a random sample of 450 pencils, approximately HOW MANY would you expect to have a diameter less than 0.293 inches? (Hint: Find a proportion first.)

Provide an appropriate response.

8) Sampling without replacement involves dependent events, so this would not be considered a binomial experiment. Explain the circumstances under which sampling without replacement could be considered independent and, thus, binomial.

9) In Hannah's school, there are 871 students of which 21% come from single–parent families. Consider the probability that among 80 randomly selected students there are at least 20 that come from single–parent families. Can this probability be found by using the binomial probability formula? Why or why not?

10) Let the random variable x represent the number of tails in five flips of a coin. Construct a table describing the probability distribution, then find the mean and standard deviation.

11) Under what conditions can we apply the results of the central limit theorem?

12) The typical computer random–number generator yields numbers in a uniform distribution between 0 and 1 with a mean of 0.500 and a standard deviation of 0.289. (a) Suppose a sample of size 50 is randomly generated. Find the probability that the mean is below 0.300. (b) Suppose a sample size of 15 is randomly generated. Find the probability that the mean is below 0.300. These two problems appear to be very similar. Only one can be solved by the central limit theorem. Which one and why?

13) SAT verbal scores are normally distributed with a mean of 430 and a standard deviation of 120 (based on the data from the College Board ATP). If a sample of 15 students is selected randomly, find the probability that the sample mean is above 500. Does the central limit theorem apply for this problem?

14) Which of the following notations represents the standard deviation of the population consisting of all sample means?

A) $\sigma_{\overline{x}}$ B) s C) $\sqrt{npq}$ D) μ

Find the indicated value.

15) $z_{0.005}$

Provide an appropriate response.

16) Tell whether the following statistic is a biased or unbiased estimator of a population parameter:
Sample range used to estimate a population range.

List three statistics tht are unbiased estimators of the corresponding population parameter.

17) Apply the Central Limit Theorem. Samples of size n = 800 are randomly selected from the population of numbers (0 through 9) produced by a random-number generator.

a) If the proportion of odd numbers is found for each sample what type of distribution is the distribution of the s proportions? What is it's mean and what is it's standard deviation?

b) If the mean of the 800 values is found for each of the samples what type of distribution is the distribution of sample mean? What is the mean and what is the standard deviation of the distribution of sample means? (please use correct notation.)

Use the given degree of confidence and sample data to construct a confidence interval for the population proportion p.

18) Of 367 randomly selected medical students, 30 said that they planned to work in a rural community. Find a 95% confidence interval for the true proportion of all medical students who plan to work in a rural community.

d) (2 Points) What is the critical value needed to calculate a 90% confidnece interval?___________

e) (2 Points) What is the point estimate for the population proportion?______________

f) (2 Points) Show the formula and the values used to calculate the margin of error

E=____________

g) (2 Points) Find a 90 percent confidence interval for the proportion of doctors who plan to work in rural communities..___________________

h) (4 Points) State the meaning of this confidence interval.

Use the given data to find the minimum sample size required to estimate the population proportion.

19) Margin of error: 0.044; confidence level: 95%; $\hat{p}$ and $\hat{q}$ unknown

20) Margin of error: 0.005; confidence level: 99%; from a prior study, $\hat{p}$ is estimated by 0.166.

Solve the problem.

21) A newspaper article about the results of a poll states: "In theory, the results of such a poll, in 99 cases out of 100 should differ by no more than 5 percentage points in either direction from what would have been obtained by interviewing all voters in the United States." Find the sample size suggested by this statement.

Use the given data to find the minimum sample size required to estimate the population proportion.

22) (5 points) Margin of error: 0.008; confidence level: 99%; from a prior study, $\hat{p}$ is estimated by 0.139.

b) Does the size of the population effect the size of the sample needed to make this confidence interval?

Solve the problem.

23) (10 Points) In a recent egg shipment 30% of the eggs were cracked.

a) Find the mean for the number of cracked eggs in a carton of 18.

b) Find the standard deviation for the number of cracked eggs in a carton of 18.

d) What is the probability that at most 3 in a random sample of 18 eggs?

e) What is the minimum and maximum usual number of broken eggs in a carton of 18.

Minimum Usual =

Maximum Usual =

c) In a random sample of 18 eggs would it be unusual to get at most 3 that are broken?

24) a) (2 Points) Define confidence interval.

b) (2 Points) Define margin of error.

b) (2 Points) Suppose a confidence interval is $0.12 < p < 0.20$. Find the sample proportion $\hat{p}$ and the error estimate E.

Use the degree of confidence and sample data to construct a confidence interval for the population proportion p.

25) When 306 college students are randomly selected and surveyed, it is found that 115 own a car. Find the point estimate for the proportion of college students who own a car, and find a 99% confidence interval for the true proportion of all college students who own a car.
What is the point estimate of the population proportion?________
What is the critical value?________
What is the margin of error? E=________
Explain the meaning of the confidence interval.

Use the given degree of confidence and sample data to construct a confidence interval for the population proportion p.

26) Of 356 randomly selected medical students, 20 said that they planned to work in a rural community. Find a 90% confidence interval for the true proportion of all medical students who plan to work in a rural community.
d) (2 Points) What is the critical value needed to calculate a 90% confidnece interval?___________

e) (2 Points) What is the point estimate for the population proportion?______________
f) (2 Points) Show the formula and the values used to calculate the margin of error

E=____________

g) (2 Points) Find a 90 percent confidence interval for the proportion of doctors who plan to work in rural communities..___________________
h) (4 Points) State the meaning of this confidence interval.

Find the minimum sample size you should use to assure that your estimate, $\hat{p}$, will be within the required margin of error around the population p.

27) A political action committee is interested in finding out what kind of popular support they might expect on an environmental initiative. Similar issues have gotten 91% support. The committee will set up a polling program to assure 95% confidence that the margin of error is less than 0.07. What is the minimum sample size they need?

28) (21 Points) A machine in a saw mill cuts pieces of lumber to an average width of $\mu = 4$ inches with a standard deviation $\sigma = .05$ inches

a) (3 Points) Graph the distribution with both an x–axes and a z–axes. Show mean and standard deviation. Calculate the z–score of a 4.08 width for a piece of lumber and label on your graph.

b) (3 Points) What is the probability that width is at least 4.08 for a piece of lumber? Show all work. Use proper probability notation, calculator inputs and shade region with equal area on the graph above.

c) (3 Points) What width separates the widest 10% of cuts? Show on a new graph.

d) (3 Points) On a given day the inspector samples 16 boards, and finds the sample mean. Find the mean $\mu_{\overline{x}}$ and standard deviation $\sigma_{\overline{x}}$ of the population of sample means for samples of size n = 16.

e) (3 Points) Find the z–score of a sample mean that is at least $\overline{x} = 4.08$ inches in the distribution of sample means.

f) (6 Points) For a sample of size 16, what is the probability that the **mean** at least $\overline{x} = 4.08$ inches in the distribution of sample means? Graph the distribution of sample means when the sample size is 16 with both an $\overline{x}$–axes and a z–axes. Does the data indicate that the machine is working properly.