MAT 1450 Name:____

Review for Exam 2

1. Scientists measured the annual forest loss (in square kilometers) in Indonesia form 2000 to 2013. They found the regression line **forest loss = 7500+(1021 x year since 2000)** for predicting forest loss in square kilometers from years since 2000.

    a. What is the slope of this line? Say in words what the numerical value of the slope tells you.

    b. If we measure forest loss in square meters per year, what would the slope be? Note that there are 10^6 square meters in a square kilometer.

    c. If we measure forest loss in thousands of square kilometers per year, what would the slope be?

2. TRUE or FALSE: Given a regression line with a small slope, it means that the correlation between the two variables is weak.

3. Researchers measured the percent body fat and the preferred amount of salt level for several children. It shows $\hat{y} = 24.2 + 6.0x$ where x represents the preferred salt level and y is the percent body fat.

    a. Find the predicted amount of body fat for a child when her preferred amount of salt level is 0.6.

    b. Assume that one of the children surveyed has body fat of 38 with the salt level 0.6. What would be the residual (prediction error) when the regression line was used?

4. The following table describes the opinions of the 570 people that returned the questionnaire in the survey on their opinion of campus residence quality (high quality, medium quality, low quality).

Class	High	Medium	Low	Total
Freshman	65	25	20	110
Sophomore	55	30	45	130
Junior	60	40	70	170
Senior	30	60	70	160
Total	210	155	205	570

a. Find the conditional probability distribution of the opinions among seniors in the college.

b. Find the marginal probability distribution of the opinions.

5. A call-in poll conducted by a local radio station concluded that race would not be an issue in the 2008 presidential election. This conclusion was based on data collected from 450 calls made by local listeners. The sampling technique being used is

a. simple random sampling.
b. stratified random sampling.
c. volunteer sampling.
d. multistage sampling.

6. The Excite Poll is an online poll at poll.excite.com. You click on an answer to become part of the sample. One poll question was "Do you prefer watching first-run movies at a movie theater, or waiting until they are available on home video or pay-per-view?" A total of 8896 people responded with 1118 saying they preferred theaters. From this survey you can conclude that

a. Americans prefer watching movies at home.
b. a larger sample is necessary.
c. the poll uses voluntary response, so the results tell us little about the population of all adults.
d. movie theaters should lower their prices.

7. A public opinion poll in Ohio wants to determine whether registered voters in the state approve of a measure to ban smoking in all public areas. The researchers select a simple random sample of 50 registered voters from each county in the state and ask whether they approve or disapprove of the measure. This is an example of
   a. a systematic county sample.
   b. a stratified sample.
   c. a multistage sample.
   d. a simple random sample.

8. I toss a penny and observe whether it lands heads up or tails up. Suppose the penny is fair, i.e., the probability of heads is 1/2 and the probability of tails is 1/2. This means
   a. every occurrence of a head must be balanced by a tail in one of the next two or three tosses.
   b. if I flip the coin many, many times, the proportion of heads will be approximately 1/2, and this proportion will tend to get closer and closer to 1/2 as the number of tosses increases. (Law of Large Numbers)
   c. regardless of the number of flips, half will be heads and half tails.
   d. All of the above

9. I roll a four-sided die. The possible outcomes are 1, 2, 3, or 4, depending on the number of spots on the side of the die that is face down. This collection of all possible outcomes is called
   a. a census.
   b. the probability.
   c. the sample space.
   d. the distribution.

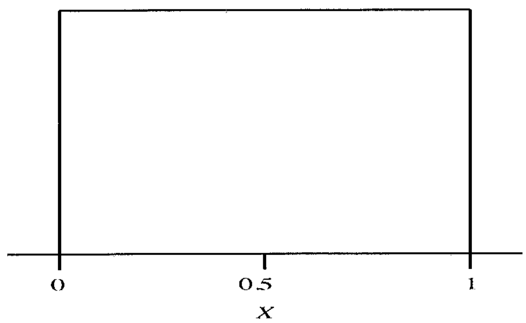
For Questions 10-12, assume that event A occurs with probability 0.4 and event B occurs with probability 0.5. Assume that A and B are disjoint events.

10. The probability that either event occurs (A or B) is
    a. 0.0
    b. 0.7
    c. 0.9
    d. 1.0

11. The probability that both events occur (A and B) is
    a. 0.0
    b. 0.2
    c. 0.7
    d. 1

12. If A and B are independent events, the probability that both events occur (A and B) is __________

13. Let the random variable X be a random number with the uniform density curve given below.



$P(0.6 < X < 0.9)$ is

a. 0.30
b. 0.40
c. 0.60
d. 0.90

14. The density curve for a continuous random variable X has which of the following properties?

a. The probability of any event is the area under the density curve and above the values of X that make up the event.
b. The total area under the density curve for X must be exactly 1.
c. The probability of any event of the form X = constant is 0.
d. All of the above

15. The amount of milk sold each day by a grocery store varies according to the Normal distribution with mean 130 gallons and standard deviation 12 gallons. On a randomly selected day, the probability that the store sells at least 154 gallons is

a. 0.0228
b. 0.1587
c. 0.8413
d. 0.9772

16. The incomes in a certain large population of college teachers have a normal distribution with mean \$75,000 and standard deviation \$10,000. 16 teachers are selected at random from this population to serve on a committee. What is the probability that their average salary is more than \$77,500?

a. 0.0228
b. 0.1587
c. 0.8413
d. Essentially 0

Use the following to answer Questions 17 and 18:

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

17. The distribution of the sample mean IQ is

a. approximately Normal, mean 112, standard deviation 25.
b. approximately Normal, mean 112, standard deviation 1.443.
c. approximately Normal, mean 112, standard deviation 0.083.
d. approximately Normal, mean equal to the observed value of the sample mean, standard deviation

18. The probability that the sample mean IQ is greater than 115 is

a. 0.019
b. 0.452
c. 0.528
d. 0.981

Use the following to answer Questions 19 and 20.

Nationwide, the amount charged by doctors for performing a particular minor surgical procedure averages $1220 and varies with a standard deviation of $300. We randomly select 160 bills from the population of all bills charged for this surgery. Let $\bar{x}$ represent the average amount charged for these 160 surgical procedures.

19. The mean and standard deviation of the average $\bar{x}$ are

a. mean = $1220 and standard deviation = $300.
b. mean = $1220 and standard deviation = $23.72.
c. mean = $122 and standard deviation = $300.
d. mean = $122 and standard deviation = $23.72.

20. The probability that the average amount charged over these 160 procedures is more than $1180 is

a. 0.046.
b. 0.448.
c. 0.552.
d. 0.954.

21. Event *A* occurs with probability 0.1. Event *B* occurs with probability 0.6. If *A* and *B* are independent, then

a. *P*(*A* and *B*) = 0.70.
b. *P*(*A* or *B*) = 0.64.
c. *P*(*A* and *B*) = 0.64.
d. *P*(*A* or *B*) = 0.70.

22. An event *A* will occur with probability 0.5. An event *B* will occur with probability 0.6. The probability that both *A* and *B* will occur is 0.1. The conditional probability of *B*, given *A*, is

a. 5/6.
b. 1/5.
c. 1/6.
d. It cannot be determined from the information given.

Use the following to answer Questions 23–25:

A manufacturing process produces bags of cookies. The distribution of content weights of these bags is Normal with mean 16.0 oz and standard deviation 0.8 oz. We will randomly select *n* bags of cookies and weigh the contents of each bag selected.

23. How many bags should be selected so that the standard deviation of the sample mean is 0.1 ounces?

a. 8 bags
b. 10 bags
c. 64 bags
d. 100 bags

24. Which of the following statements is true with respect to the sampling distribution of the sample mean, $\bar{x}$?

a. If the sample size, *n*, increases, the standard deviation of $\bar{x}$ will decrease.
b. If the population standard deviation increases, the standard deviation of $\bar{x}$ will increase.
c. According to the law of large numbers, if the sample size, *n*, increases, $\bar{x}$ will tend to be closer to 16 ounces.
d. All of the above

25. If 100 bags of cookies are selected randomly, the probability that the sample mean will be between 15.84 and 16.16 ounces is

a. 0.046.
b. 0.110.
c. 0.890.
d. 0.954.

26. An event *A* will occur with probability 0.5. An event *B* will occur with probability 0.6. The probability that both *A* and *B* will occur is 0.1. We may conclude

a. events *A* and *B* are independent.
b. events *A* and *B* are disjoint.
c. either *A* or *B* always occurs.
d. None of the above

Answer key:

1a)1021,For each year since 2000, the forest loss averages about 1021km^2, 1b)1021x10^6; a loss of 1 billion square meters per year in average 1c)In thousands of km^2, the slope would be 1.021

2 False

3a) 27.8 3b) 10.2

4a) Among the seniors, 18.75% rated the residence quality high, 37.5% medium, and 4.75% low.

4b) High 36.84%, medium 27.19%, low 35.96%

5/c, 6/c, 7/b, 8/b, 9/c, 10/c, 11/a, 12/0.2, 13/a, 14/d, 15/a, 16/b, 17/b, 18/a, 19/b, 20/d, 21/b, 22/b, 23/c, 24/d, 25/d, 26/c

MAT 1450 Name:____

Review for Exam 2

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   a. What is the slope of this line? Say in words what the numerical value of the slope tells you.

   1021 for each year, forest loss increases 1021 sq. km

   b. If we measure forest loss in square meters per year, what would the slope be? Note that there are 10^6 square meters in a square kilometer.

   $1021(10^6)$

   c. If we measure forest loss in thousands of square kilometers per year, what would the slope be?

   1021

   1.021 thous. of sq. mi

2. TRUE or FALSE: Given a regression line with a small slope, it means that the correlation between the two variables is weak.

3. Researchers measured the percent body fat and the preferred amount of salt level for several children. It shows $\hat{y} = 24.2 + 6.0x$ where x represents the preferred salt level and y is the percent body fat.

   a. Find the predicted amount of body fat for a child when her preferred amount of salt level is 0.6.

   $\hat{y} = 24.2 + 6(.6)$

   $\hat{y} = 27.8\%$

   b. Assume that one of the children surveyed has body fat of 38 with the salt level 0.6. What would be the residual (prediction error) when the regression line was used?

   res $= y - \hat{y}$

   $38 - 27.8$

   10.2%

   $\hat{y} = 24.2 + 6(.6)$

   $= 27.8$

4. The following table describes the opinions of the 570 people that returned the questionnaire in the survey on their opinion of campus residence quality (high quality, medium quality, low quality).

Class	High	Medium	Low	Total
Freshman	65	25	20	110
Sophomore	55	30	45	130
Junior	60	40	70	170
Senior	30	60	70	160
Total	210	155	205	570

a. Find the conditional probability distribution of the opinions among seniors in the college.

H M L

Sen $\frac{30}{160} = .1875$ $\frac{60}{160} = .375$ $\frac{70}{160} = .4375$

b. Find the marginal probability distribution of the opinions.

H M L

total $\frac{210}{570} = .368$ $\frac{155}{570} = .272$ $\frac{205}{570} = .360$

5. A call-in poll conducted by a local radio station concluded that race would not be an issue in the 2008 presidential election. This conclusion was based on data collected from 450 calls made by local listeners. The sampling technique being used is

a. simple random sampling.
b. stratified random sampling.
c. volunteer sampling.
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   b. a stratified sample.
   c. a multistage sample.
   d. a simple random sample.

8. I toss a penny and observe whether it lands heads up or tails up. Suppose the penny is fair, i.e., the probability of heads is 1/2 and the probability of tails is 1/2. This means
   a. every occurrence of a head must be balanced by a tail in one of the next two or three tosses.
   b. if I flip the coin many, many times, the proportion of heads will be approximately 1/2, and this proportion will tend to get closer and closer to 1/2 as the number of tosses increases. (Law of Large Numbers)
   c. regardless of the number of flips, half will be heads and half tails.
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9. I roll a four-sided die. The possible outcomes are 1, 2, 3, or 4, depending on the number of spots on the side of the die that is face down. This collection of all possible outcomes is called
   a. a census.
   b. the probability.
   c. the sample space.
   d. the distribution.

For Questions 10-12, assume that event A occurs with probability 0.4 and event B occurs with probability 0.5. Assume that A and B are disjoint events.

$P(A) = .4$
$P(B) = .5$
$P(A \cap B) = 0$

10. The probability that either event occurs (A or B) is
   a. 0.0
   b. 0.7
   c. 0.9
   d. 1.0

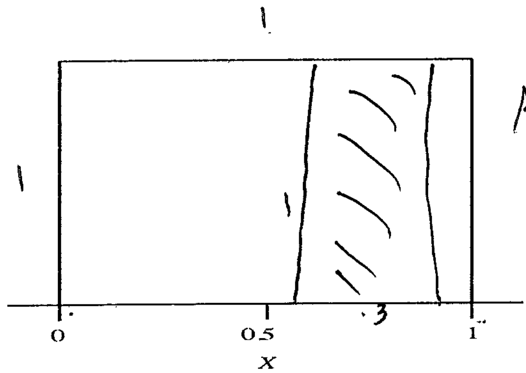
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$.4 + .5 - 0 = .9$

11. The probability that both events occur (A and B) is
   a. 0.0
   b. 0.2
   c. 0.7
   d. 1

12. If A and B are independent events, the probability that both events occur (A and B) is .2

$P(A \cap B) = P(A) \cdot P(B)$
$.4 \cdot .5 = .2$

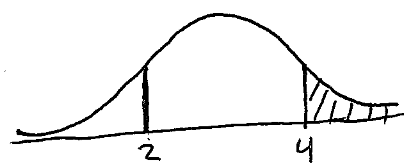
13. Let the random variable X be a random number with the uniform density curve given below.



Area = 1

$P(0.6 < X < 0.9)$ is $\quad .9 - .6 = .3$

a. 0.30
b. 0.40
c. 0.60
d. 0.90



14. The density curve for a continuous random variable X has which of the following properties?

a. The probability of any event is the area under the density curve and above the values of X that make up the event.
b. The total area under the density curve for X must be exactly 1.
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d. All of the above

15. The amount of milk sold each day by a grocery store varies according to the Normal distribution with mean 130 gallons and standard deviation 12 gallons. On a randomly selected day, the probability that the store sells at least 154 gallons is

a. 0.0228
b. 0.1587
c. 0.8413
d. 0.9772

$\mu = 130$
$\sigma = 12$
$P(X \geq 154) = .023$

16. The incomes in a certain large population of college teachers have a normal distribution with mean $75,000 and standard deviation $10,000. 16 teachers are selected at random from this population to serve on a committee. What is the probability that their average salary is more than $77,500?

a. 0.0228
b. 0.1587
c. 0.8413
d. Essentially 0

$\mu = 75000$ $\quad n = 16$
$\sigma = 10,000$ $\quad \frac{10000}{\sqrt{16}} = 2500$
$\bar{x} = 77500$

$\mu_{\bar{x}} = 75000$
$\sigma_{\bar{x}} = 2500$
$P(\bar{x} \geq 77500) = .1587$

Use the following to answer Questions 17 and 18:

$\mu = 112$ $\quad n = 300$

$\sigma = 25$ $\quad \sigma_{\bar{x}} = \frac{25}{\sqrt{300}} = 1.44$

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

$\mu_{\bar{x}} = 112$

$\sigma_{\bar{x}} = 1.44$

17. The distribution of the sample mean IQ is

a. approximately Normal, mean 112, standard deviation 25.
b. approximately Normal, mean 112, standard deviation 1.443.
c. approximately Normal, mean 112, standard deviation 0.083.
d. approximately Normal, mean equal to the observed value of the sample mean, standard deviation

18. The probability that the sample mean IQ is greater than 115 is

$P(\bar{x} \geq 115) = .018$

a. 0.019
b. 0.452
c. 0.528
d. 0.981

Use the following to answer Questions 19 and 20.

$\mu = 1220$ $\quad n = 160$

$\sigma = 300$ $\quad \sigma_{\bar{x}} = \frac{300}{\sqrt{160}} = 23.72$

Nationwide, the amount charged by doctors for performing a particular minor surgical procedure averages $1220 and varies with a standard deviation of $300. We randomly select 160 bills from the population of all bills charged for this surgery. Let $\bar{x}$ represent the average amount charged for these 160 surgical procedures.

19. The mean and standard deviation of the average $\bar{x}$ are

a. mean = $1220 and standard deviation = $300.
b. mean = $1220 and standard deviation = $23.72.
c. mean = $122 and standard deviation = $300.
d. mean = $122 and standard deviation = $23.72.

20. The probability that the average amount charged over these 160 procedures is more than $1180 is

a. 0.046.
b. 0.448.
c. 0.552.
d. 0.954.

$P(\bar{x} \geq 1180) = .954$

21. Event *A* occurs with probability 0.1. Event *B* occurs with probability 0.6. If *A* and *B* are independent, then

a. *P*(*A* and *B*) = 0.70.
b. *P*(*A* or *B*) = 0.64.
c. *P*(*A* and *B*) = 0.64.
d. *P*(*A* or *B*) = 0.70.

$P(A) = .1$

$P(B) = .6$

$P(A) \cdot P(B) = P(A \cap B)$

$(.1)(.6) = .06$

$P(A) + P(B) - P(A \cap B)$

$.1 + .6 - .06 = .64$

22. An event *A* will occur with probability 0.5. An event *B* will occur with probability 0.6. The probability that both *A* and *B* will occur is 0.1. The conditional probability of *B*, given *A*, is

a. 5/6.
b. 1/5.
c. 1/6.
d. It cannot be determined from the information given.

$P(A) = .5$

$P(B) = .6$

$P(A \cap B) = .1$

$P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{.1}{.5} = \frac{1}{5} = .2$

Use the following to answer Questions 23–25:

A manufacturing process produces bags of cookies. The distribution of content weights of these bags is Normal with mean 16.0 oz and standard deviation 0.8 oz. We will randomly select *n* bags of cookies and weigh the contents of each bag selected.

$\mu = 16 \quad \sigma = .8$

23. How many bags should be selected so that the standard deviation of the sample mean is 0.1 ounces?

a. 8 bags
b. 10 bags
c. 64 bags
d. 100 bags

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

$.1 = \frac{.8}{\sqrt{n}}$

$.1\sqrt{n} = .8$
$\sqrt{n} = 8$
$n = 8^2 = 64$

24. Which of the following statements is true with respect to the sampling distribution of the sample mean, $\bar{x}$?

T a. If the sample size, *n*, increases, the standard deviation of $\bar{x}$ will decrease.
T b. If the population standard deviation increases, the standard deviation of $\bar{x}$ will increase.
T c. According to the law of large numbers, if the sample size, *n*, increases, $\bar{x}$ will tend to be closer to 16 ounces.
d. All of the above

25. If 100 bags of cookies are selected randomly, the probability that the sample mean will be between 15.84 and 16.16 ounces is

a. 0.046.
b. 0.110.
c. 0.890.
d. 0.954.

$\mu = 16$
$\sigma = .8 \quad \sigma_{\bar{x}} = \frac{.8}{\sqrt{100}} = .08$
$n = 100$

$P(15.84 \le \bar{x} \le 16.16)$
$.95$

26. An event *A* will occur with probability 0.5. An event *B* will occur with probability 0.6. The probability that both *A* and *B* will occur is 0.1. We may conclude

a. events *A* and *B* are independent.
b. events *A* and *B* are disjoint.
c. either *A* or *B* always occurs.
d. None of the above

$P(A) = .5$
$P(B) = .6$
$P(A \cap B) = .1$
not disjoint

indep $P(A) \cdot P(B) = P(A \cap B)$
$.5 \cdot .6 \stackrel{?}{=} .1$ NO

$P(A \cup B) = 1 \,?$
$.5 + .6 - .1 = 1$

Answer key:

1a)1021,For each year since 2000, the forest loss averages about 1021km^2 , 1b)1021x10^6; a loss of 1 billion square meters per year in average 1c)In thousands of km^2 , the slope would be 1.021

2 False

3a) 27.8 3b) 10.2

4a) Among the seniors, 18.75% rated the residence quality high, 37.5% medium, and 4.75% low.

4b) High 36.84%, medium 27.19%, low 35.96%

5/c, 6/c, 7/b, 8/b, 9/c, 10/c, 11/a, 12/0.2, 13/a, 14/d, 15/a, 16/b, 17/b, 18/a, 19/b, 20/d, 21/c, 22/d, 23/d, 24/b, 25/b, 26/c