

Exam 1, Fall 2016

- 1) For any two random variables X and Y , if $\text{Var}(X + Y) = \text{Var}(X) + \text{Var}(Y)$, then the correlation between X and Y must be zero.
 - a) True
 - b) False
- 2) If X and Y are independent random variables, then the standard deviation of $X+Y$ is the standard deviation of X plus the standard deviation of Y .
 - a) True
 - b) False
- 3) If X is a random variable, $E(X)$ must be less than 1.
 - a) True
 - b) False
- 4) If E and F are independent events, then $P(E)$ cannot be equal to $P(F)$.
 - a) True
 - b) False
- 5) The statement “Of those surveyed, 59% said they favored the death penalty” is an example of the use of descriptive statistics.
 - a) True
 - b) False
- 6) In a set of numerical data, the value of Q_3 can never be smaller than the value of Q_1
 - a) True
 - b) False
- 7) In a sample size of 40, the sample mean is 15. In this case, the sum of all observations in the sample is 600
 - a) True
 - b) False
- 8) We know that the distribution of wealth in the United States is right skewed. Thus, the majority of people in the US have more than the average (i.e. mean) level of wealth
 - a) True
 - b) False

9) The standard deviation of a discrete random variable σ is the positive square root of its:

- a) Variance
- b) Mean
- c) Range
- d) IQR
- e) Mode

10) Jim, Cathy, Alex, and Sue are all thinking of going to a party. Jim has a 20% probability of going; for Cathy, it's more like 70%. The probability of Alex going is 90%, and the probability of Sue going is 60%. They do not consult with each other beforehand, so they are not affected by the other people's decisions of whether or not to go. What is the probability that they are all at the party?

- a) 0.188
- b) 0.091
- c) 0.372
- d) 0.065
- e) 0.076

11) Suppose X and Y are independent random variables, and suppose X is binomial with $n = 10$ and $p = .4$; while Y is binomial with $n = 12$ and $p = .2$. Find the variance of $2X + 3Y$.

- a) 26.88
- b) 44.86
- c) 32.51
- d) 20.41
- e) 13.95

12) A construction company is bidding on the chance to do two different projects: a movie theater and a skating rink. The probability of getting the bid to do the movie theater is 20%. If the probability of getting the bid to do both is 1%, what should the probability of getting the bid to do the skating rink be for the two events to be independent?

- a) 0.02
- b) 0.03
- c) 0.04
- d) 0.05
- e) 0.06

13) Find the expected value of the following random variable:

$X =$	0	2	3	5
$prob.$	$.5$	$.1$	$.3$	$.1$

- a) 2.7
- b) 1.2
- c) 1.6
- d) 2.1
- e) 1.8

14) The average amount earned by 110 juniors for a week was \$35, while during the same week 90 seniors averaged \$50. What were the average earnings for that week for the combined group?

- a) \$41.75
- b) \$42.50
- c) \$43.50
- d) \$47.55

15) In a certain game of chance, your chances of winning are 0.2. If you play the game five times and outcomes are independent, the probability that you win at least once is

- a) 0.74
- b) 0.33
- c) 0.67
- d) 0.92
- e) 0.46

16) The annual cost of owning a dog is a normal random variable with mean \$695 and standard deviation \$45. The annual cost of owning a cat is a normal random variable with mean \$705 and standard deviation \$35. What is the probability that the total annual cost of owning one dog and two cats exceeds \$2000? [assume dog and cat ownership is independent].

- a) 0.6466
- b) 0.7180
- c) 0.8251
- d) 0.8965
- e) 0.9322

17) At a local community college, 90% of students take English, 80% of those who don't take English take art courses, while only 50% of those who do take English take art. What is the probability that someone takes art?

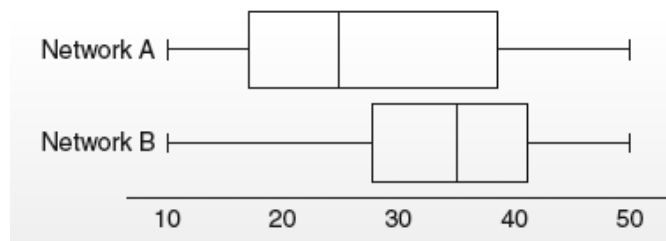
- a) .45
- b) .90
- c) .53
- d) .10
- e) .08

18) Which of the following statements is (are) correct?

- I. The area under a probability density curve for a continuous random variable is 1.
- II. A random variable is a numerical outcome of a random event.
- III. The sum of the probabilities for a discrete random variable is 1.

- a) I only
- b) II only
- c) I and III
- d) II and III
- e) I, II and III

19) An advertiser is trying to decide which television station in town to use for his product. He gathers the ratings of all prime time shows on each network and constructs a boxplot of each. There are the same number of ratings for each network. The results are as follows. Based on these boxplots, which of the following is a correct conclusion about the relative ratings for the two networks?



- a) The median rating for Network A is greater than for Network B.
- b) The range for Network A is greater than for Network B
- c) The IQR for the two networks is the same.
- d) There are more ratings greater than 28 for Network A than for Network B.
- e) The median rating for Network B is higher than for Network A.

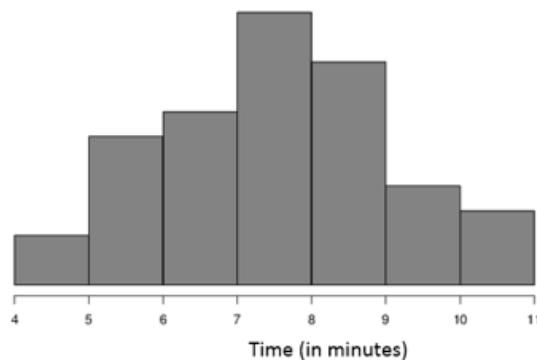
20) A factory utilizes two different production lines (A and B) for manufacturing gizmos. Since production line A is faster, it is able to produce 60% of the gizmos, with the remaining gizmos coming off of production line B. It is known that 2% of the gizmos from production line A and 4% of the gizmos from production line B will contain some small defect. Based upon this, if a gizmo is randomly selected from among all gizmos produced at this factory and the gizmo is found to have a defect, what is the probability the gizmo came off production line B?

- a) 0.667
- b) 0.5
- c) 0.571
- d) 0.429
- e) 0.016

21) The length of songs played by a certain radio station is normally distributed with a mean of 210 seconds and a standard deviation of 25 seconds. If Angela turns on the radio just in time to catch the beginning of a new song, what is the probability the song will last between 170 and 225 seconds?

- a) 0.05
- b) 0.25
- c) 0.67
- d) 0.73
- e) 0.90

22) The amount of time it took students to run a mile in gym class was recorded. The histogram below shows the distribution of time (in minutes) for these students.



Which of the following is closest to the standard deviation of the one mile times?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 6

23) On an EC10 midterm, the mean was 77, with a standard deviation of 10. If the professor adds 5 points to each score, what will be the new mean and standard deviation?

- a) Mean 77, standard deviation 10
- b) Mean 77, standard deviation 15
- c) Mean 82, standard deviation 10
- d) Mean 82, standard deviation 13

24) A local real estate agent is interested in the relationship between the cost of a house (y) in dollars and its area (x) in square feet. She randomly selects 50 houses around town and computes the least squares regression line: $\hat{y} = 14578.01 + 136.89x$

Which of the following is the correct interpretation of the slope of the least squares regression line?

- a) For each dollar increase, the estimated square footage of the house increases by 136.89.
- b) For each dollar increase, the estimated square footage of the house increases by 14578.01.
- c) For each additional square foot, the estimated cost of the house increases by \$136.90.
- d) For each additional square foot, the estimated cost of the house increases by \$14578.01
- e) Since we are not given the data points, it is impossible to interpret the slope of the least squares regression line in this problem

25) The U.S. Census Bureau reports that Americans spend an average of $\mu=24.3$ minutes commuting to work each day. Assuming that the distribution of commuting times is normal with a standard deviation of $\sigma=10$ minutes, how much time do you have to spend commuting each day to be in the highest 30% nationwide?

- a) 29.5
- b) 44.4
- c) 26.6
- d) 37.1
- e) 41.8

26) Suppose $X \sim \text{Unif}(0,9)$. Find $E(X^2)$.

- a) 9
- b) 3
- c) 4.5
- d) 27
- e) 21

27) Which one of the following statements are true for any continuous random variable

- a) The maximum value of $F(x)$ is 1
- b) The maximum value of $f(x)$ is 1
- c) Both (a) and (b)
- d) None of these

28) Which of the following is true about any discrete random variable X ?

- 1) The expected value of $X = np$.
- 2) The sum of all possible values of X is equal to 1.
- 3) The probabilities of all possible values of X must add up to 1.
- 4) The probability distribution is bell-shaped and symmetrical.
- 5) Approximately 95 percent of the values of X fall within 2 standard deviations of the mean.

29) A random sample of records of electricity usage of homes in the month of July gives the amount of electricity used and size (in square feet) of 135 homes. A regression was done to predict the amount of electricity used (in kilowatt-hours) from size. The resulting model is: usage = 1204 + 0.6 size. How much electricity would you predict would be used in a house that is 2273 square feet?

- a) 2567.8 kilowatt-hours
- b) 3477.6 kilowatt-hours
- c) 159.8 kilowatt-hours
- d) 1363.8 kilowatt-hours
- e) 1781.67 kilowatt-hours

30) Consider the same regression model as described in the problem above. What would a negative residual imply for people living in a house that is 2284 square feet?

- a) Their house is bigger than expected.
- b) They are using the least amount of electricity of all of the houses sampled.
- c) Their house is smaller than expected.
- d) They are using less electricity than expected.
- e) They are using more electricity than expected.

31) A study was done that measured the association between people's vertical jump ability (how high they can jump from a stationary position) and how much they can leg press. The resulting correlation was 0.98. Which of the following statements are true?

- i) If you leg press more than someone else, then you will have a higher vertical jump than him or her.
 - ii) If you leg press less than someone else, you will have a lower vertical jump than him or her.
 - iii) There is a very strong positive linear association between leg press ability and vertical jump.
- a) i only
 - b) ii only
 - c) iii only
 - d) i and ii only
 - e) i, ii and iii

32) Consider the following joint probability table:

		Y			
		0	5	10	15
X	0	0.02	0.06	0.02	0.1
	5	0.04	0.15	0.2	0.1
	10	0.01	0.15	0.14	0.01

Find $P(X=5|Y=5)$

- a) 0.5
- b) 0.42
- c) 0.22
- d) 0.08
- e) 0.86

33) Based on the following output, what is the correlation between variables x and y?

```
. summ x y
```

Variable	Obs	Mean	Std. Dev.	Min	Max
x	74	21.2973	5.785503	12	41
y	74	13.75676	4.277404	5	23

```
. corr x y, cov
(obs=74)
```

	x	y
x	33.472	
y	-14.3924	18.2962

- a. -0.44
- b. -0.63
- c. -0.32
- d. -0.58
- e. -0.14

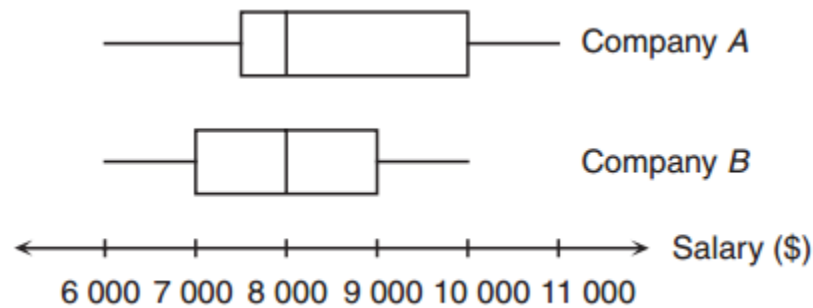
Answers:

- 1) A
- 2) B
- 3) B
- 4) B
- 5) A
- 6) A
- 7) A
- 8) B
- 9) A
- 10) E
- 11) A
- 12) D
- 13) C
- 14) A
- 15) C
- 16) D
- 17) C
- 18) E
- 19) E
- 20) C
- 21) C
- 22) B
- 23) C
- 24) C
- 25) A
- 26) D
- 27) A
- 28) C
- 29) A
- 30) D
- 31) C
- 32) B
- 33) D

Exam 1, Spring 2017

- 1) For a continuous random variable, the total area beneath the pdf must be one.
 - a. True
 - b. False
- 2) The second quartile is the same as median.
 - a. True
 - b. False
- 3) Given the data set 10, 5, 2, 6, 3, 4, 20, the median value is 5.
 - a. True
 - b. False
- 4) $P(A \text{ or } B)$ can exceed one.
 - a. True
 - b. False
- 5) Of the range, the interquartile range, and the variance, the interquartile range is least influenced by an outlying value in the data set.
 - a. True
 - b. False
- 6) 15 cards are selected out of a 52 card deck such that after each card is selected, it is placed back into the deck and the deck is reshuffled. Then the total number of hearts selected follows a binomial distribution.
 - a. True
 - b. False
- 7) If the equation of the least squares regression line was computed to be $y=45.7+3.1x$, then the correlation cannot be less than 0.
 - a. True
 - b. False
- 8) A researcher found the correlation between age of death and number of cigarettes smoked per day to be -0.95. Based just on this information, the researcher can justly conclude that smoking causes early death.
 - a. True
 - b. False

- 9) The box-and-whisker diagrams below show the salaries distributions of two companies. Which of the following measures are the same for these two companies?



- a) Range
 - b) Median
 - c) Lower quartile
 - d) Inter-quartile range
- 10) Information was collected on those who attended the opening of a new movie. The analysis found that 56 percent of the moviegoers were female, 26 percent were under age 25, and of those under the age of 25, 17 percent were females. Find the probability that a moviegoer is either female or under age 25.
- a) 0.78
 - b) 0.82
 - c) 0.65
 - d) 0.50
 - e) 0.35
- 11) There are two traffic lights on the route used by Pickup Andropov to go from home to work. Let E denote the event that Pickup must stop at the first light and F in a similar manner for the second light. Suppose that $P(E) = .4$ and $P(F) = .3$ and $P(E \text{ and } F) = .15$. What is the probability that he doesn't stop at either light.
- a) 0.66
 - b) 0.27
 - c) 0.45
 - d) 0.80
 - e) 0.20

12) The mean and the standard deviation of the ages of a group of children are 7 and 1.31 respectively. If a child of age 7 joins the group of children, what are the effects on the mean and the standard deviation of the ages of the group of children?

- a) Mean Unchanged, Standard deviation Increased
- b) Mean Unchanged, Standard deviation Decreased
- c) Mean Increased, Standard deviation Increased
- d) Mean Decreased, Standard deviation Decreased

13) A certain model car comes in a two-door version, a four-door version, and a hatchback version. Each version can be equipped with either an automatic transmission or a manual transmission. The accompanying table gives the relevant proportions for purchases.

	Two-Door	Four-Door	Hatchback
Automatic	.32	.27	.18
Manual	.08	.04	.11

A customer who has purchased one of these cars was randomly selected. Given that a customer did not purchase a hatchback, what is the probability that the car has a manual transmission?

- a) 0.64
- b) 0.83
- c) 0.18
- d) 0.08
- e) 0.38

14) Leah is flying from Boston to Denver with a connection in Chicago. The probability her first flight leaves on time is 0.15. If the flight is on time, the probability that her luggage will make the connecting flight is 0.95, but if the first flight is delayed, the probability that the luggage will make it is only 0.65. What is the probability that her luggage arrives in Denver with her?

- a) 0.40
- b) 0.20
- c) 0.70
- d) 0.80
- e) 0.15

15) Foresters use regression to predict the volume of timber in a tree using easily measured quantities such as diameter. Let y be the volume of timber in cubic feet and x be the diameter in inches. One set of data gives $y = -30 + 60x$. The predicted volume for a tree of 18 inches is:

- a) 1050 cubic feet
- b) 600 cubic feet
- c) 104 cubic feet
- d) 90 cubic feet
- e) 60 cubic feet

16) The probability that an engine will not start is 0.04. A rocket has four independent engines. What is the probability that at least one of the engines does not start?

- a) 0.82
- b) 0.0006
- c) 0.15
- d) 0.04
- e) 0.001

17) Consider a Poisson random variable with rate parameter 7. Then $E[X^2]$ equals

- a) 7
- b) 42
- c) 27
- d) 56
- e) 49

18) Which of the following is not a requirement of a binomial distribution?

- a) constant probability of success
- b) only two possible Bernoulli outcomes
- c) fixed number of trials
- d) equally likely outcomes.

19) A company Orange manufactures a hand-held device uPhone. Each uPhone has a probability 10% of being defective, independently of other units. Let X be the number of defective uPhones in a batch of 900 uPhones. The variance of X is

- a) 3
- b) 9
- c) 81
- d) 90
- e) 56

20) Suppose the time (in minutes) Lisa spends grading an Ec 10 quiz is uniformly distributed in the interval (5,15). If Lisa has already spent 9 minutes grading a quiz, what is the probability she will spend a total of at least 12 minutes grading the quiz?

- a) $3/6$
- b) $3/10$
- c) $12/15$
- d) $3/15$
- e) $4/5$

21) The speed of cars traveling on a stretch of Interstate 5 in California is approximately normally distributed with a mean of 72.6 miles/hour and a standard deviation of 4.78 miles/hour. The legal speed limit posted on this stretch of Interstate 5 is 70 miles/hour. 60% of all cars on this stretch of Interstate 5 are going at most how fast?

- a) 73.8 mph
- b) 71.4 mph
- c) 68.8 mph
- d) 69.2 mph
- e) 72.7 mph

22) The regression line $\hat{y} = 3 + 2x$ has been fitted to the data points (4, 8), (2, 5), and (1, 2). The sum of the squared residuals will be:

- a) 7
- b) 15
- c) 8
- d) 22
- e) 17

23) A regression analysis between sales (y in \$1000) and advertising (x in \$) resulted in the following least squares line: $\hat{y} = 80,000 + 5x$. This implies that an:

- a) increase of \$1 in advertising is expected, on average, to result in an increase of \$5 in sales
- b) increase of \$5 in advertising is expected, on average, to result in an increase of \$5,000 in sales
- c) increase of \$1 in advertising is expected, on average, to result in an increase of \$80,005 in sales
- d) increase of \$1 in advertising is expected, on average, to result in an increase of \$5,000 in sales

24) Let X represent a random variable whose distribution is normal with 100 and standard deviation of 10. Which of the following is equivalent to $P(X > 115)$?

- a) $P(X < 115)$
- b) $P(X < 85)$
- c) $P(X > 15)$
- d) $P(85 < X < 115)$
- e) $1 - P(X < 85)$

25) The mean annual salary of employees at a company is \$40,000 with a standard deviation of \$3500. At the end of the year, each employee receives a \$2000 bonus and a 4% raise (based on salary). What is the standard deviation of the new salaries?

- a) 3360
- b) 3872
- c) 3546
- d) 3640
- e) 3905

26) Let X and Y be independent random variables with $X \sim N(0, 1)$ and $Y \sim N(0, 2)$. The value of $P(X > Y)$ is

- a) 0
- b) 0.05
- c) 0.50
- d) 0.95
- e) 0.45

27) The statistics below provide a summary of the distribution of heights, in inches, for a simple random sample of 200 young children.

Mean: 46 inches
Median: 45 inches
Standard Deviation: 3 inches
First Quartile: 43 inches
Third Quartile: 48 inches

About 100 children in the sample have heights that are

- a) Less than 43 inches
- b) Less than 48 inches
- c) Between 43 and 48 inches
- d) Between 40 and 52 inches
- e) More than 46 inches

28) A delivery service places packages into large containers before flying them across the country. These filled containers vary greatly in their weight. Suppose the delivery service's airplanes always transport two such containers on each flight. The two containers are chosen so their combined weight is close to, but does not exceed, a specified weight limit. A random sample of flights with these containers is taken, and the weight of each of the two containers on each selected flight is recorded. The weights of the two containers on the same flight

- a) will have a correlation of 0
- b) will have a negative correlation
- c) will have a positive correlation that is less than 1
- d) will have a correlation of 1
- e) cannot be determined from the information given

29) Let X be a random variable with the following probability mass function; $P(X = -1) = 0.2, P(X = 0) = 0.4, P(X = 1) = 0.4$ Compute $P(X = 0 | X \leq 1)$.

- a) 0.2
- b) 0.4
- c) 0.5
- d) 0.3
- e) None of the above

30) Let X and Y be two random variables with the following joint probability distribution;
 $P(X = -1 \text{ and } Y = -1) = 1/3$, $P(X = 0 \text{ and } Y = 0) = 1/3$ and $P(X = 1 \text{ and } Y = 1) = 1/3$
Compute $P(XY = 1)$.

- a) 0
- b) $1/9$
- c) $1/3$
- d) $2/3$
- e) $2/9$

31) You have an equally-weighted portfolio of two stocks, Microsoft and McDonald's (the weights are .5 in each asset). The standard deviations of Microsoft and McDonald's are 20 and 15 respectively. Your portfolio standard deviation is 15. What is the covariance of Microsoft and McDonald's?

- a) 0.62
- b) 138
- c) 92
- d) 100
- e) 0.46

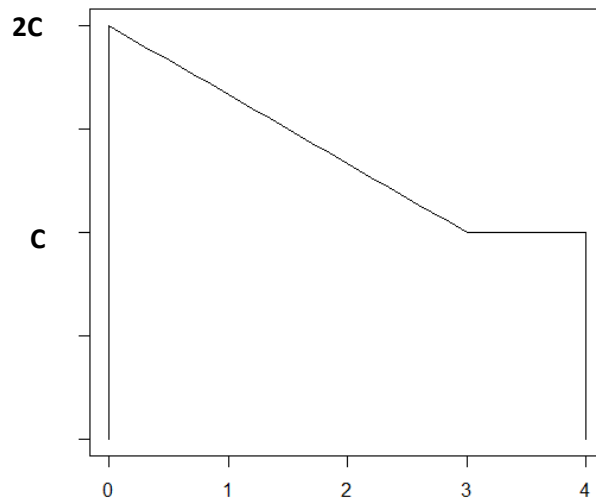
32) Suppose that X is a normal random variable with mean 5. If $P(X > 9) = .2$, approximately what is $\text{Var}[X]$?

- a) 20.6
- b) 18.9
- c) 16.2
- d) 23.8
- e) 22.7

33) A councilman claims that 40% of residents support a tax increase on alcoholic beverages. A polling agent is going to sample 30 residents. Let X be the number of people out of 30 who are in favor of the tax. If F represents the cumulative distribution function for the appropriate binomial distribution, what is the probability that at least ten but less than twenty-five of the residents sampled would support such a tax increase on alcoholic beverages?

- a) $F(25) - F(10)$
- b) $F(24) - F(9)$
- c) $F(24) - F(10)$
- d) $F(25) - F(9)$

34) A continuous random variable X has the following density function.



Find the value of c .

- a) 0.32
- b) 0.20
- c) 0.18
- d) 0.25
- e) 0.21

35) Below are summary statistics for two salespersons, John and Sue. The data are based on weekly sales for 52 weeks.

Variable	N	Mean	StDev
John	52	967.3	97.3
Sue	52	1063.3	171.4

Covariances

	John	Sue
John	???????	
Sue	7459.97	29364.36

What is the correlation between John's sales and Sue's sales?

- a) 0.87
- b) 0.57
- c) 0.24
- d) 0.63
- e) 0.45

36) For a given high school basketball team, the number of baskets (X) for the leading scorer has $E(X) = 8.3$ with standard deviation 1.25 and the number of baskets (Y) for the second leading scorer has $E(Y) = 6.6$ with standard deviation 2.31. Hypothetically, let's say the leading scorer shoots only 3-point baskets and the second leading scorer only shoots 2-point baskets and they shoot independently of each other. What is the standard deviation of the difference in points scored between the leading scored and second leading scorer?

- a) 5.95
- b) 2.67
- c) 3.87
- d) 7.02
- e) 4.51

37) Nicole adores chocolate! She often purchases chocolate when she is out shopping at the grocery store. Let X be the number of chocolate bars that Nicole purchases on one visit to the grocery store. The following describe Nicole's chocolate purchasing habits.

- 89.6% of the time Nicole purchases at least two chocolate bars
- She **never** purchases just one chocolate bar
- She **never** purchases more than 4 chocolate bars
- 25.5% of the time, Nicole purchases buys at most 2 bars
- 42.8% of the time, Nicole purchases more than 3 chocolate bars
- 10.4% of the time, Nicole does not purchase any chocolate bars

What is the expected number of chocolate bars she will purchase?

- a) 2.61
- b) 3.41
- c) 2.11
- d) 2.97
- e) 3.07

38) The lengths of brook trout caught in a certain Colorado stream are normally distributed with a mean of 14 inches and a standard deviation of 3 inches. What proportion of brook trout caught will be between 12 and 18 inches in length?

- a) 0.66
- b) 0.87
- c) 0.27
- d) 0.41
- e) 0.33

Answers:

- 1) A
- 2) A
- 3) A
- 4) B
- 5) A
- 6) A
- 7) A
- 8) B
- 9) B
- 10) A
- 11) C
- 12) B
- 13) E
- 14) C
- 15) A
- 16) C
- 17) D
- 18) D
- 19) C
- 20) A
- 21) A
- 22) D
- 23) D
- 24) B
- 25) D
- 26) C
- 27) C
- 28) B
- 29) B
- 30) D
- 31) B
- 32) E
- 33) B
- 34) C
- 35) E
- 36) A
- 37) D
- 38) A