Math 1070 -   Spring '11 - Midterm 1

Name: _____   Date: _____

1. We want to determine the correlation between the height (in inches) and scoring average (points per game) of women on a college basketball team. To do this, we record the height and scoring average of two players on the team. The values are

	Player #1	Player #2
Height	70	75
Scoring average	11.0	20.0

The correlation r computed from the measurements on these players is
A) 1.0.
B) positive and between 0.25 and 0.75.
C) near 0, but could be either positive or negative.
D) exactly 0.

2. The five-number summary of a set of data
A) is the mean, standard deviation, first quartile, median, and third quartile.
B) is the mean, median, mode, variance, and standard deviation.
C) is the minimum, the first and third quartiles, the median, and the maximum.
D) is the minimum, the interquartile range, the mean, the median, and the maximum.

3. 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 refer 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.

4. Consider the following scatterplot of the horsepower of several models of cars vs. gas mileage (mpg).
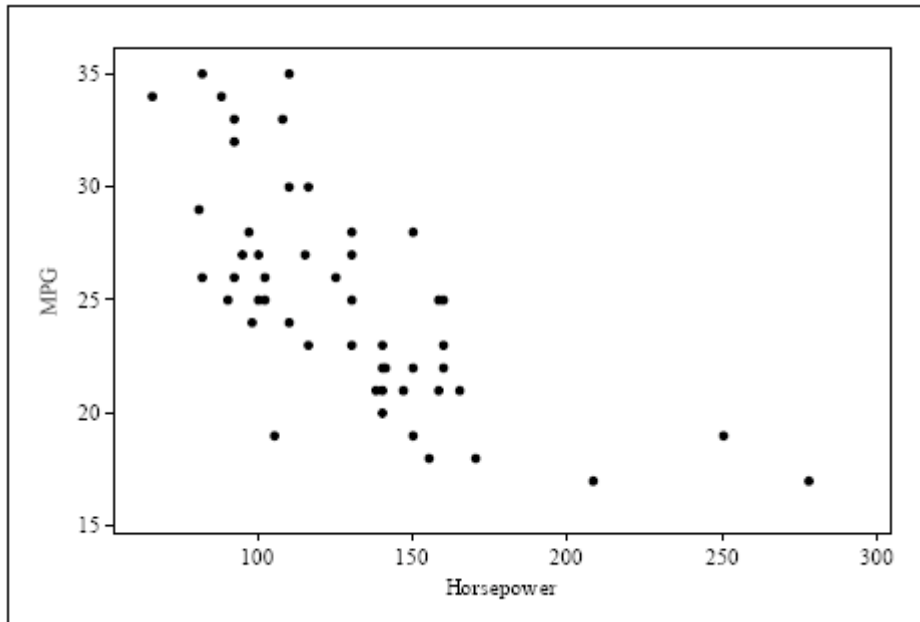
The correlation between x and y
A) is approximately 0.8.
B) is approximately – 0.7.
C) is approximately 0.0.
D) cannot be computed because the trend is curved.

5. A locomotive's "adhesion" is the locomotive's pulling force as a multiple of its weight. This is an important performance measure of a locomotive. A diesel locomotive model has adhesion which varies in actual use according to a Normal distribution with mean 0.37 and standard deviation 0.04.   The first quartile for the adhesion distribution is
A) 0.04.
B) 0.25.
C) 0.29 hours.
D) 0.34 hours.

6. The following histogram represents the distribution of acceptance rates (percent accepted) among 25 business schools in 2004. In each class interval, the left endpoint is included but not the right, so the class intervals are 10 ≤ rate < 15, 15 ≤ rate < 20, etc.
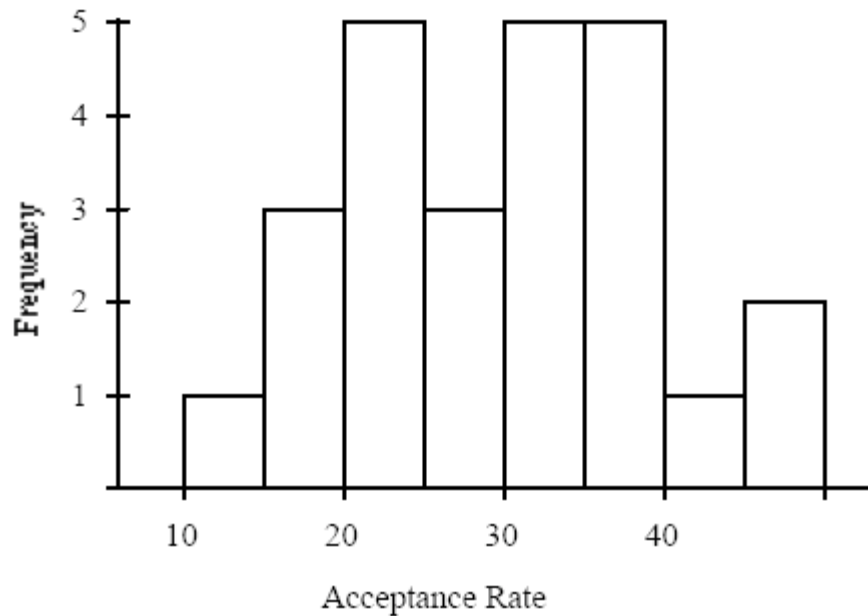
Acceptance Rate

The number of schools with acceptance rates over 30% is
A) 5.
B) 12.
C) 10.
D) 13.

7. A researcher observes that, on average, the number of divorces in cities with major league baseball teams is larger than in cities without major league baseball teams. The most plausible explanation for this observed association is
A) the presence of a major league baseball team causes the number of divorces to rise.
B) the high number of divorces is responsible for the presence of a major league baseball teams.
C) the association is due to the presence of a lurking variable (major league teams tend to be in large cities with more people, hence a greater number of divorces).
D) the observed association is purely coincidental. It is implausible to believe the observed association could be anything other than accidental.

8. Suppose we fit the least-squares regression line to a set of data. The plot of the residuals is given below.
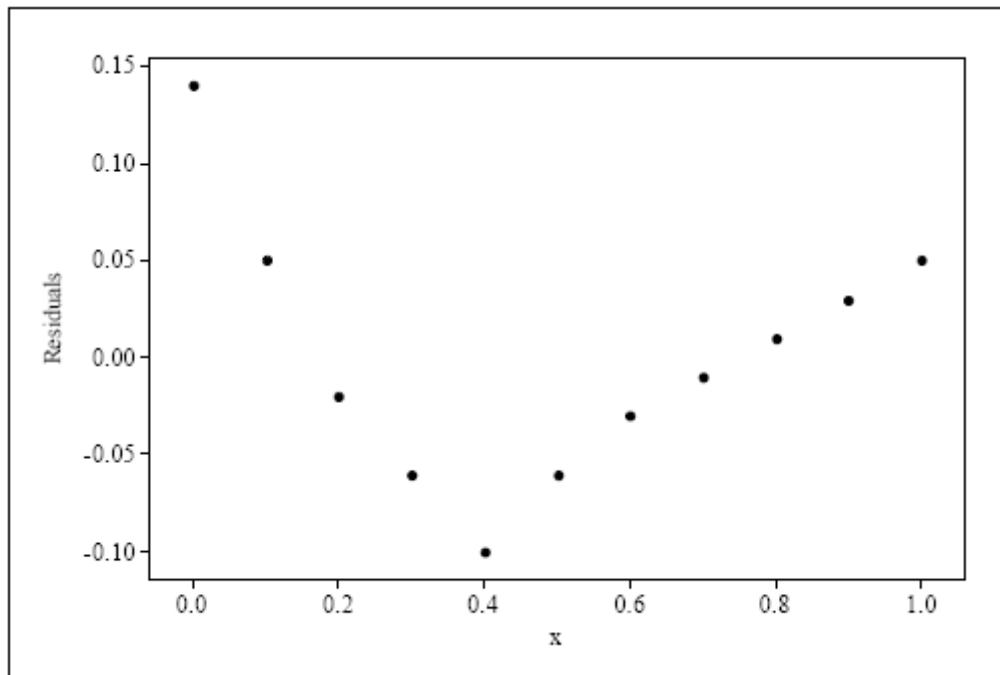
This plot suggests
A) a straight line is not a good summary for the data.
B) the correlation must be 0.
C) the correlation must be positive.
D) outliers must be present.

9. Your dance class contains 9 students. You need to select a simple random sample of size four to go on the New York trip. The following is the list of students.

1. Kendell	4. Johnnie	7. Emily
2. Alysha	5. Lucy	8. Natalie
3. Kelsey	6. Jennifer	9. Devon

To do this, use the numerical labels attached to the previous names and the following list of random digits. Read the list of random digits from left to right, starting at the beginning of the list.
27798 12009 45287 71753 98236 66419 84533 11793 20495 05907 11384

The simple random sample is
A) 2779.
B) 2798.
C) Alysha, Emily, Devon, and Natalie.
D) Alysha, Emily twice, and Devon.

10. The scores on the Wechsler Adult Intelligence Scale are approximately Normal with $\mu = 100$ and $\sigma = 15$. What is the proportion of adults with scores above 130?
   A) 0.001.
   B) 0.025.
   C) 0.050.
   D) 0.950.

11. John's parents recorded his height at various ages up to 66 months. Below is a record of the results.

Age (months)	36	48	54	60	66
Height (inches)	35	38	41	43	45

   John's parents decide to use the least-squares regression line of John's height on age based on the data in the previous problem to predict his height at age 21 years (252 months). We conclude
   A) John's height, in inches, should be about half his age, in months.
   B) The parents will get a fairly accurate estimate of his height at age 21 years, since the data are clearly correlated.
   C) such a prediction could be misleading, since it involves extrapolation.
   D) all of the above.

12. Each month the census bureau mails survey forms to 250,000 households asking questions about the people living in the household and about such things as motor vehicles and housing costs. Telephone calls are made to households that don't return the form. In one month, responses were obtained from 240,000 of the households contacted. The sample is
   A) the 250,000 households initially contacted.
   B) the 240,000 households that respond.
   C) the 10,000 households that did not respond.
   D) all U.S. households.

13. Consumers' Union measured the gas mileage per gallon of 38 1998–99 model automobiles on a special test track. The following pie chart provides information about the country of manufacture of the model cars that Consumers' Union used.
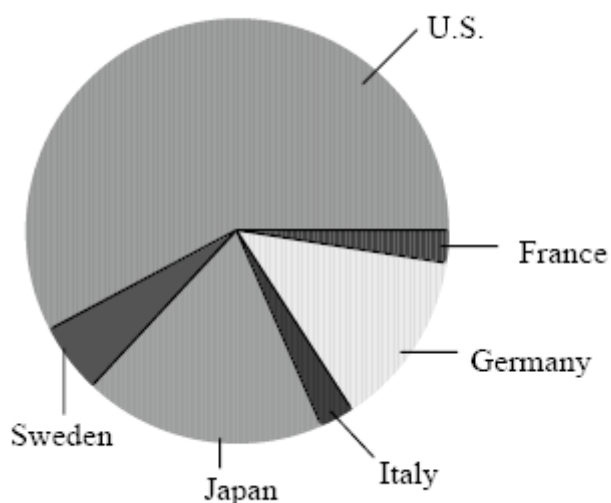
Which of the following bar graphs is equivalent to the pie chart?

A)
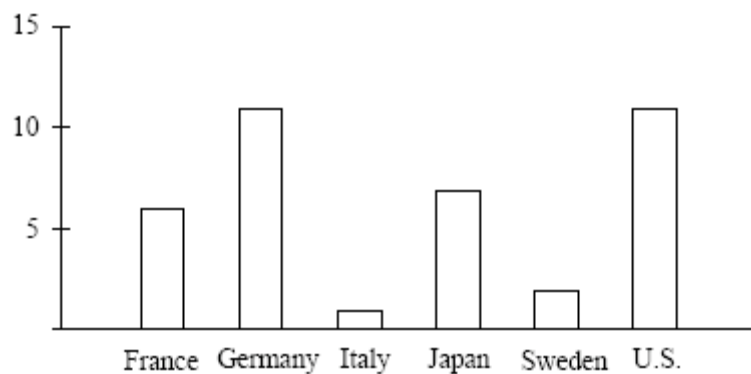
B)
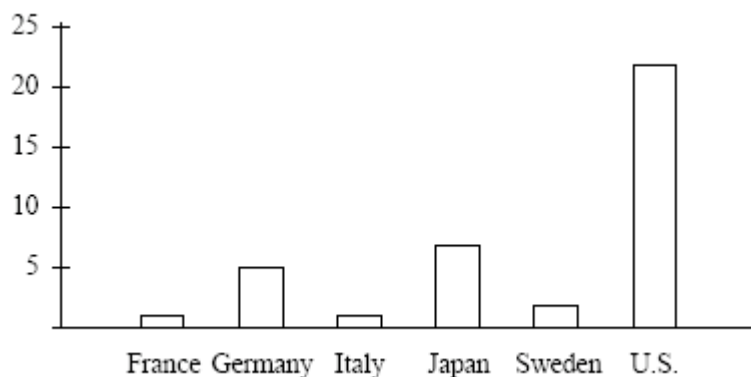
C)
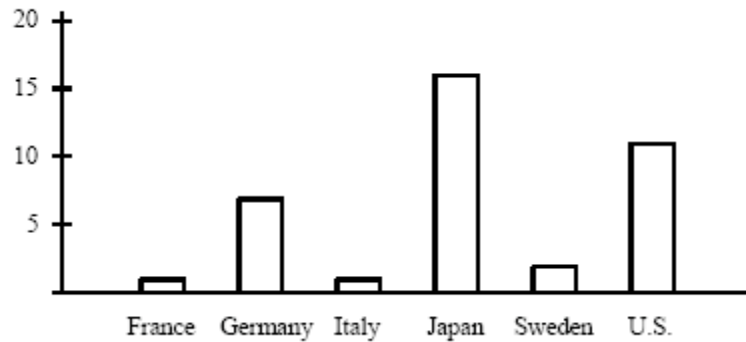
D)
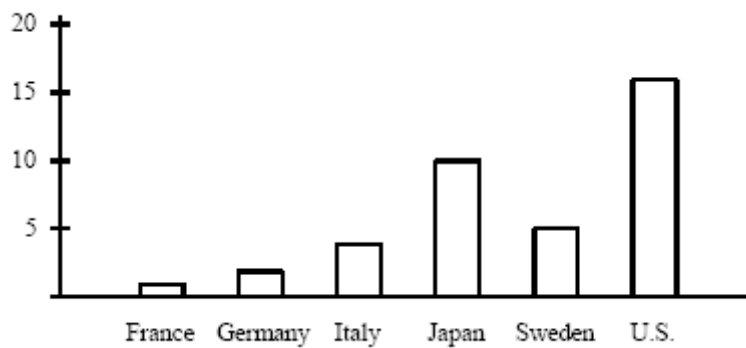
14. A congressman wants to know how voters in his district feel about a government bailout of the auto industry. He mails a questionnaire on this subject to an SRS of 1200 voters in his district. Of the 1200 questionnaires mailed, 221 were returned and of these 182 were opposed to the bailout. The population is
    A) the 1200 voters receiving the questionnaire.
    B) the 221 questionnaires returned.
    C) the 182 voters opposed to the bailout.
    D) the voters in his district.

15. In a study, fast-food menu items were analyzed for their fat content (measured in grams) and calorie content. The goal is to predict the number of calories in a menu item from knowing its fat content. The least-squares regression line was computed, and added to a scatterplot of the these data:

Regression of Calories on Fat for Fast Food Menu Items
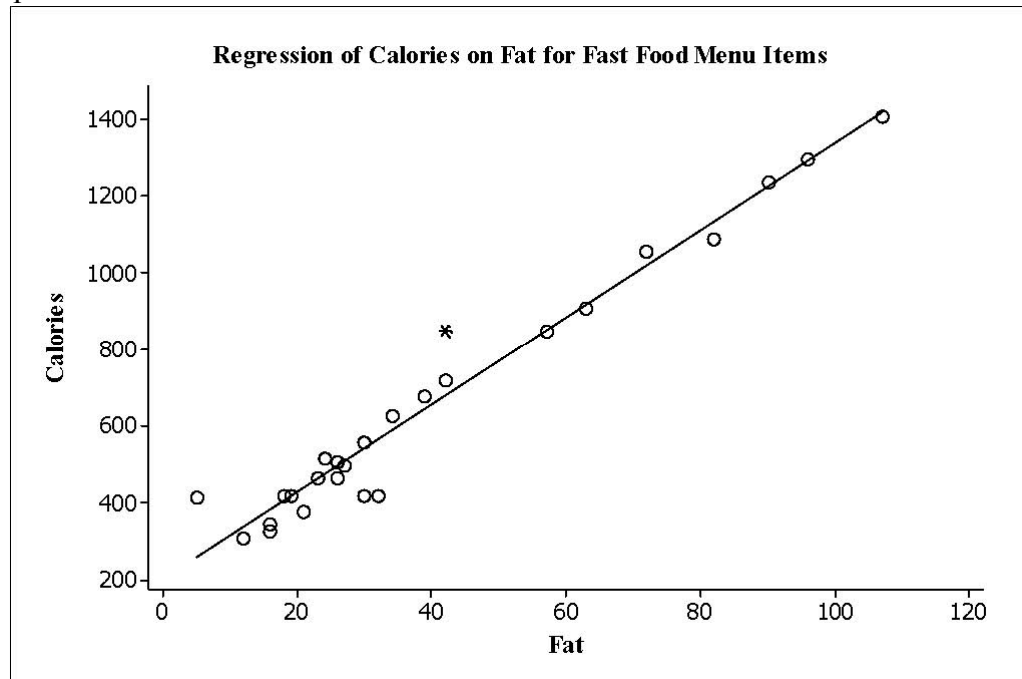
The equation of the least-squares regression line is:

Calories = 204 + 11.4 x (Fat)

The correlation between Calories and Fat is $r = .979$. Hence, $r^2 = .958$.

Finally, the average number of calories in menu items is 660, and the average fat content in menu items is 40 grams.

Which of the following statements is true?

A) About 95.8% of the variation in calories for menu items is explained by the regression on Fat content.

B) According to the least-squares regression line, the number of calories in a non-fat menu item (Fat = 0) is predicted to be 204.

C) According to the least-squares regression line, we would predict an increase of 11.4 calories if we add one gram of fat to a menu item.

D) All of the above.

TABLES AND FORMULAS FOR MOORE
Basic Practice of Statistics

Exploring Data: Distributions

- Look for overall pattern (shape, center, spread) and deviations (outliers).

- Mean (use a calculator):

$$\overline{x} = \frac{x_1 + x_2 + \cdots + x_n}{n} = \frac{1}{n}\sum x_i$$

- Standard deviation (use a calculator):

$$s = \sqrt{\frac{1}{n-1}\sum(x_i - \overline{x})^2}$$

- Median: Arrange all observations from smallest to largest. The median M is located $(n+1)/2$ observations from the beginning of this list.

- Quartiles: The first quartile Q_1 is the median of the observations whose position in the ordered list is to the left of the location of the overall median. The third quartile Q_3 is the median of the observations to the right of the location of the overall median.

- Five-number summary:

$$\text{Minimum}, \ \ Q_1, \ \ M, \ \ Q_3, \ \ \text{Maximum}$$

- Standardized value of x:

$$z = \frac{x - \mu}{\sigma}$$

Exploring Data: Relationships

- Look for overall pattern (form, direction, strength) and deviations (outliers, influential observations).

- Correlation (use a calculator):

$$r = \frac{1}{n-1}\sum\left(\frac{x_i - \overline{x}}{s_x}\right)\left(\frac{y_i - \overline{y}}{s_y}\right)$$

- Least-squares regression line (use a calculator): $\hat{y} = a + bx$ with slope $b = rs_y/s_x$ and intercept $a = \overline{y} - b\overline{x}$

- Residuals:

$$\text{residual} = \text{observed } y - \text{predicted } y = y - \hat{y}$$

TABLE A   **Standard Normal probabilities**

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

Name: _____ Date: _____

      Ⓐ Ⓑ ⬤ Ⓓ

1. Ⓐ Ⓑ Ⓒ Ⓓ

2. Ⓐ Ⓑ Ⓒ Ⓓ

3. Ⓐ Ⓑ Ⓒ Ⓓ

4. Ⓐ Ⓑ Ⓒ Ⓓ

5. Ⓐ Ⓑ Ⓒ Ⓓ

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9. Ⓐ Ⓑ Ⓒ Ⓓ

10. Ⓐ Ⓑ Ⓒ Ⓓ

11. Ⓐ Ⓑ Ⓒ Ⓓ

12. Ⓐ Ⓑ Ⓒ Ⓓ

13. Ⓐ Ⓑ Ⓒ Ⓓ

14. Ⓐ Ⓑ Ⓒ Ⓓ

15. Ⓐ Ⓑ Ⓒ Ⓓ

16. Does exposure to classical music (through instrument lessons or concert attendance) improve children's scholastic performance? In a study, researchers measured the amount of exposure to classical music for many children, along with their scores on the state's academic proficiency exam. What is the explanatory variable and what is the response variable?

17. As part of a data base on new births at a hospital some variables recorded are the age of the mother, marital status of the mother (single, married, divorced), weight of the baby, and gender of the baby. Which variables are categorical and which are quantitative?

18. The level of various substances in the blood is known to influence our health. Below are measurements of the level of phosphate in the blood of a patient, in milligrams of phosphate per deciliter of blood, made on 5 consecutive visits to a clinic.

    5.6   5.2   4.6   4.9   5.7

    Find the standard deviation.

19. A student wonders if people of similar heights tend to date each other. She measures herself, her dormitory roommate, and the women in the adjoining rooms; then she measures the next man each woman dates. Here are the data (heights in inches).

Women	66	64	66
Men	72	68	70

We already found that the correlation r=0.866, the standard devation of women heights is 1.1547, and the standard deviation for men heights is 2. Find the regression line. If a woman is 67 inches tall, what is your best guess of the height of her next date?
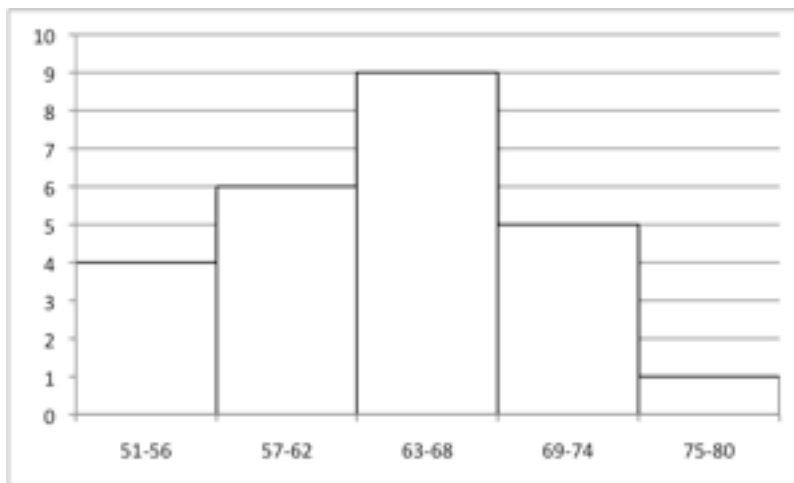
20. Birthweights at a local hospital have a Normal distribution with a mean of 110 oz and a standard deviation of 15 oz. What is the proportion of infants with birthweights between 125 oz and 140 oz?

21. The following are the heights (in inches) of 25 students in a given class. Draw the histogram.
    51, 53, 55, 55, 57, 59, 60, 60, 62, 62, 63, 63, 64, 66, 66, 67, 68, 68, 68, 69, 70, 70, 72, 74, 78

Answer Key - Midterm1-S11

1. A
2. C
3. C
4. B
5. D
6. D
7. C
8. A
9. C
10. B
11. C
12. B
13. B
14. D
15. D
16. Explanatory: amount of a child's exposure to classical music. Response: score on the state's academic proficiency exam.
17. Categorical: gender and marital status. Quantitative: Age and weight.
18. 0.4637
19. y=1.5x-28. If x=67, then y=72.5 in.
20. 0.136.
21.