

**No Calculator**                      **Middleton High School Invitational**  
**- February 18, 2006 - Statistics Competition**

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1. In Ms. Woolfenden's class of AP Statistics students, a test was conducted to determine the distribution of student GPA's. After a nerve-racking month of collecting and analyzing data, the test showed the student GPA's to be skewed to the left, with mean 2.40 and mode 2.96. Decide upon which value would most nearly fit the median GPA.

- A. 2.14                      B. 2.38                      C. 3.23                      D. 2.86                      E. NOTA

2. The least squares regression line of  $y$  on  $x$  was determined to be  $\hat{y} = mx + b$ , where  $m$  and  $b$  are

represented as constants. The coefficient of determination is equal to 0.25 and  $\frac{s_x}{s_y} = \frac{1}{2}$ . If the least squares

regression line passes through  $\bar{X} = 2$  and  $\bar{Y} = 2$ , find the value of  $m^2 + b^2$ . Round answers to its thousandths position.

- A. 3.078                      B. 2.313                      C. 1.250                      D. 1.000                      E. NOTA

3. If variables  $U$  and  $F$  are independent and given that  $p(U) = 1/3$  and  $p(F) = 1/6$  determine the probability value of  $p(U \text{ or } F)$ .

- A.  $\frac{1}{2}$                       B.  $\frac{1}{3}$                       C.  $\frac{4}{9}$                       D.  $\frac{5}{9}$                       E. NOTA

4. In a test conducted by the WhizKids of Middleton, they unbiasedly rolled two, fair six-sided die and found the probability that their sum would equal a number greater than or equal to 7. Due to some outer forces distracting the concentration of the WhizKids though, they fear that their calculation might have been flawed. Determine the correct value for this test.

- A.  $\frac{5}{12}$                       B.  $\frac{7}{12}$                       C.  $\frac{1}{2}$                       D.  $\frac{1}{4}$                       E. NOTA



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9. Suppose  $P(\text{passing the AP Stat exam}) = 1/5$  and  $P(\text{passing the AP class}) = 2/5$ . If

$P(\text{passing the AP Stat exam} | \text{passing the AP class}) = 3/25$ , what is

$P(\text{passing the AP class} | \text{passing the AP Stat exam})$ ?

- A.  $\frac{1}{5}$       B.  $\frac{2}{5}$       C.  $\frac{3}{50}$       D.  $\frac{6}{25}$       E. NOTA

10. Given a normal distribution centered at 11 with variance of 2.25, which of the following approximates the Z-score associated with the data point 12.25 to the nearest hundredth?

- A. -0.83      B. -0.56      C. 0.83      D. 5.00      E. NOTA

11. Which of the following correctly describes the concept of a Type II error?

- A. Failure to reject a true null hypothesis.  
B. Rejecting a true null hypothesis.  
C. Failing to reject a false null hypothesis.  
D. Rejecting a false null hypothesis.  
E. NOTA

12. A continuous random variable, Z, is uniformly distributed between the values of 0 and 30, inclusively.

What is the probability that  $Z > 25$ ?

- A.  $\frac{1}{6}$       B.  $\frac{1}{4}$       C.  $\frac{3}{4}$       D.  $\frac{5}{6}$       E. NOTA

13. A statistical observation of the Middleton's superheroes, The Woolfenator and The Super Spasmodic Squirrel, provided that their success rate formed a geometric distribution with probability of success  $1/5$ .

What is the probability that it takes more than 5 battles (trials) to see their first victory (success)?

- A.  $\frac{1}{5^4}$       B.  $\frac{1}{5^5}$       C.  $\frac{4^4}{5^4}$       D.  $\frac{4^5}{5^5}$       E. NOTA

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14. Refer to #13, what is the probability that the first success will come on the 5<sup>th</sup> battle (trial)?

- A.  $\frac{4}{5^4}$               B.  $\frac{4}{5^5}$               C.  $\frac{4^4}{5^5}$               D.  $\frac{4^5}{5^5}$               E. NOTA

15. Please refer back to Question 13. If the distribution of Middleton's superheroes was limited to 5 battles (trials), what is the probability that they win exactly four battles (successes)?

- A.  $\frac{4}{5^4}$               B.  $\frac{4}{5^5}$               C.  $\frac{4^4}{5^5}$               D.  $\frac{4^5}{5^5}$               E. NOTA

16. Which of the following is **NOT** true for chi-square distributions?

- A. Each Chi-squared is skewed to the left.
- B. Total area under the curve is 1.
- C. The more degrees of freedom a chi-square has, the more normal it appears.
- D. All chi-squares decrease asymptotically to the X-axis as x-values get large.
- E. NOTA

17. The random variable J has a mean of 3.1 and a standard deviation of 3. The random variable U has a mean of 2.9 and a standard deviation of 4. Assume the correlation between J and U is 1. Determine the mean and standard deviation when summing J and U together. Answers will be written in the form: (mean, standard deviation)

- A. (3, 5)              B. (3, 7)              C. (6, 5)              D. (6, 7)              E. NOTA

18. In an odd third dimensional realm, the length of ET-like creature's fingers has a standard deviation of 1.5 meter. What sample size would be needed in order for us to be 95.44% confident of knowing that the length of their fingers is within  $\pm 1$  meter?

- A. 3              B. 7              C. 8              D. 9              E. NOTA

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Use the following chart for questions 19 to 22. Note that this information is not fact, but made up for the simplicity of this problem.

In a series of tests, conducted by the Mueller is Weiss Company, to determine the number of cows that are infected with “Mad Cow Disease”, they took a sample size of 100 cows from each of the states, California, Florida, Georgia, and New York, and determined how many cows were infected with the disease. The following table shows the results of their findings.

	California	Florida	Georgia	New York
Yes	24	56	10	36
No	76	44	90	64

19. Determine the probability of cows infected with “Mad Cow Disease” from the entire sample size.

- A.  $\frac{137}{200}$       B.  $\frac{6}{25}$       C.  $\frac{8}{25}$       D.  $\frac{63}{200}$       E. NOTA

20. In carrying out a  $\chi^2$  test, determine the expected value of cows not having the disease and being from Florida.

- A. 63/2      B. 137/2      C. 44      D. 100      E. NOTA

21. Out of all the cows that do not have the disease, what is the conditional probability that they are from Florida?

- A.  $\frac{4}{9}$       B.  $\frac{22}{137}$       C.  $\frac{11}{100}$       D.  $\frac{11}{25}$       E. NOTA

22. How many degrees of freedom will there be if you carried out a  $\chi^2$  test?

- A. 3      B. 6      C. 8      D. 16      E. NOTA

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23. If variables P and G are independent, what is the probability of P given G, if  $P(P) = 0.2$  and  $P(G) = 0.7$ ?
- A. 0.14                      B. 0.2                      C. 0.7                      D. 0.9                      E. NOTA
24. In a Calculus test administered by the infamous Pam Allison, Jorge scored a 96% and William scored an 89%. In a class of 8 students, if the average scored on the test was a 64%, what is the average of the remainder of the class, excluding Jorge and William? Round to the nearest percentage.
- A. 33                      B. 36                      C. 54                      D. 55                      E. NOTA
25. What is the definition of power?
- A. The probability that we will reject the false null hypothesis.  
B. The probability that we will reject the false alternate hypothesis.  
C. The probability that we will accept the false null hypothesis.  
D. The probability that we will accept the false alternate hypothesis.  
E. NOTA
26. If statisticians were given a 99% confidence intervals based on a sample size N, what would be a correct interpretation of this result?
- A. 99% of the sample means of size N will fall within this interval.  
B. 99% of the sample means of size  $\sqrt{N}$  will fall within this interval.  
C. This sampling process is 99% effective in finding the true population mean.  
D. If this sampling process is repeated many times, the resulting confidence intervals will contain the population mean 99% of the time.  
E. NOTA
27. How many of the following types of measurements will yield a result within the interval  $[0, \infty)$ ?
- I. Correlation                      II. Coefficient of Determination                      III. Standard Deviation  
IV. Variance                      V. Chi-Squared Value                      VI. Probability
- A. 2                      B. 3                      C. 4                      D. 5                      E. NOTA

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28. A really smart mathematician conducts a linear regression procedure on a data set  $X$ , where it measures the size of human brains to determine  $Y$ , the size of the person's head. If the least-squares regression procedure yields  $X = 1.5Y + 2$ , what is the correct interpretation of the slope?

- A. For every 1 unit decrease in  $Y$ ,  $X$  decreases by 1.5 units.
- B. For every 1 unit increase in  $Y$ ,  $X$  increases by 1.5 units
- C. For every 1 additional unit of a person's brain size, the person's head size is predicted to increase by 1.5 units.
- D. For every 1 additional unit of a person's brain size, the person's head size is predicted to increase by  $2/3$  unit.
- E. NOTA

29. Pedro decides to hit the slots, to test if lady luck's with him. He sits down on a \$5 slot machine and the expected net payouts are as follows: winning \$100 with a probability of 0.01, winning \$20 with a probability of 0.05, and losing \$1 with a probability of 0.5 (It's a special type of slot machine.). Assuming that the remaining probability values result in him losing only the original \$5, determine the expected net value payout.

- A. -3.5                      B. -0.7                      C. 1.5                      D. 2.5                      E. NOTA

30. Assume a statistical test yields a p-value  $< \alpha$ , where  $\alpha$  is a predetermined statistical significance level.

Which of the following is a statistically correct conclusion of the result?

- A. Reject the null hypothesis.
- B. Fail to reject the null hypothesis.
- C. Reject the alternate hypothesis.
- D. Fail to reject the alternate hypothesis.
- E. NOTA