Note: There are 20 questions in total. Each one is 5 points. Please choose one answer for each question. No extra points will be deducted for wrong answers.

1. In how many ways can the letters in AAANSYSU be linearly arranged? (a) 40320; (b) 13440 (c) 6720; (d) 3360.

2. In how many ways can the letters in AAANSYSU be linearly arranged such that all the A's are adjacent? (a) 720; (b) 360; (c) 240; (d) 180.

3. In how many ways can the letters in AAANSYSU be linearly arranged such that N and U are adjacent? (a) 840; (b) 420; (c) 210; (d) 140.

4. What is the probability that a random, linear arrangement of the letters in AAANSYSU starts and ends with the letter S? (a) $\frac{1}{112}$; (b) $\frac{1}{56}$; (c) $\frac{1}{28}$; (d) $\frac{1}{14}$.

5. What is the coefficient of $x^7 y^3$ in the expansion of $(\frac{1}{2}x - 3y)^{10}$? (a) $-\frac{405}{8}$; (b) $-\frac{405}{16}$; (c) $-\frac{405}{32}$; (d) $-\frac{405}{64}$.

6. What is the sum of all the coefficients in the expansion of $(x + y)^{11}$? (a) 256; (b) 512; (c) 1024; (d) 2048.

7. Let p, q be primitive statements for which $p \rightarrow q$ is false. Which of the following is true? (a) $p \wedge q$; (b) $\neg p \vee q$; (c) $q \rightarrow p$; (d) $\neg q \rightarrow \neg p$.

8. Let p, q be arbitrary statements. Which of the following is equivalent to $p \rightarrow q$? (a) $p \wedge q$; (b) $p \vee \neg q$; (c) $\neg q \rightarrow p$; (d) $\neg q \rightarrow \neg p$.

9. Let p, q, and r be arbitrary statements. If $p \rightarrow r$ is true and $\neg p \rightarrow q$ is true, which of the following is also true? (a) $\neg r \rightarrow q$; (b) $r \rightarrow q$; (c) $\neg r \vee q$; (d) $r \vee \neg q$.

10. If a set S has 127 proper subsets, what is $|S|$? (a) 128; (b) 254; (c) 256; (d) 512.

11. How many subsets of $\{3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13\}$ contain at least one even integer? (a) 1981; (b) 1982; (c) 1983; (d) 1984.

12. What is the value of n, a positive integer, for which $\sum_{i=1}^{n}(i + 9) = \sum_{i=1}^{n}(2i - 1)$? (a) 17; (b) 18; (c) 19; (d) 20.

13. Let $b_1 = 3$ and $b_{n+1} = b_n + 3n + 2$ for $n \geq 1$. What is b_{10}? (a) 176; (b) 156; (c) 136; (d) 116.

14. If we want to totally make sure at least two of n different people have birthdays that occur on the same day of January, what is the minimum for n? (a) 64; (b) 32; (c) 2; (d) 31.

15. Let $S = \{$Alan, John, Jone, Sam, Don, Mary, Tom, Bill$\}$. How many subsets are there which contain both Sam and Tom? (a) 16; (b) 32; (c) 48; (d) 64.

16. A company gets graphics cards from two sources. The first source provides 40% of the cards, and the second source provides 60% of the cards. Past experience has shown that $\frac{1}{8}$ of the cards from the first source are found to be defective, while $\frac{1}{6}$ of the cards from the second source are found to be defective. If a graphics cards is selected and found to be defective, what is the probability it was provided by the first source? (a) $\frac{1}{6}$; (b) $\frac{2}{6}$; (c) $\frac{3}{6}$; (d) $\frac{4}{6}$.

17. The number of bacteria is 100 initially, and the number doubles every four hours. How many bacteria are there after one day? (a) 6400; (b) 3200; (c) 1600; (d) 800.

18. What is x for making the equation $\log_{10} x - \log_{10} 6 = 2$ hold? (a) 1000; (b) 9; (c) 300; (d) 600.

19. Let A, B, C be matrices. Which of the following is true? (a) IF AB and BA are computable, then $AB = BA$; (b) If $AB = AC$, then $B = C$; (c) If $A + B = A + C$, then $B = C$; (d) If A is square, then A is invertible.

20. If $\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = 13$, what is the value of $\begin{vmatrix} 2a & 3b & 4c \\ 2d & 3e & 4f \\ 2g & 3h & 4i \end{vmatrix}$? (a) 312; (b) 156; (c) 104; (d) 52.

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