

This test consists of 25 equally weighted questions.

1. Given a two-step procedure where there are n_1 ways to do Task 1, and n_2 ways to do Task 2 after completing Task 1, then there are _____ ways to do the procedure.
 - a. $n_1 + n_2$
 - b. $n_1 \log n_2$
 - c. $n_1 * n_2$
 - d. n_1^2

2. How many bit strings of length 10 begin with 1101?
 - a. 2^{10}
 - b. 2^6
 - c. 2^4
 - d. None of the above.

3. The 10-digit telephone numbering system in North America traditionally defined the Area Code as being NYX, the Office Code as NNX, and the Station Code as XXXX, where N is an integer in the range 2 through 9, Y is either a 0 or 1, and X is an integer from 0 through 9. How many area codes were there?
 - a. 800
 - b. 640
 - c. 480
 - d. 160

4. The telephone numbering system in North America was modified to format individual telephone numbers using NXX-NXX-XXXX, where N is an integer in the range 2 through 9 and X is an integer from 0 through 9. How many different telephone numbers are now possible in North America?
- a. 6,400,000,000
 - b. 4,800,000,000
 - c. 2,560,000,000
 - d. 1,024,000,000

5. What is the value of k after the following code terminates?

```
k := 0
for i1 := 1 to 2
  for i2 := 1 to 2
    for i3 := 1 to 2
      for i4 := 1 to 2
        for i5 := 1 to 2
          for i6 := 1 to 2
            for i7 := 1 to 2
              for i8 := 1 to 2
                for i9 := 1 to 2
                  k := k + 1
```

- a. 256
 - b. 512
 - c. 1,024
 - d. 2,048
6. In a version of programming language BASIC, variable names must be a string of one or two alphanumeric characters, where uppercase and lowercase letters are not distinguished. [Alphanumeric characters are the 26 letters of the English alphabet {A, B,...,Z} plus the digits {0,1,...,9}.] A variable name must begin with a letter. You are offered \$1,000 to define a unique variable name to identify each of 1,000 students in a school database. You reasonably decide to:
- a. accept the task and begin work because you need \$1,000.
 - b. explain that the goal is mathematically impossible because of your knowledge of discrete math and the product rule.
 - c. explain that the goal is mathematically possible provided you can use the dollar sign (\$) as an alphanumeric character.
 - d. agree to take on the task, provided you may use the programming language C++, which is not so constrained, to generate the list.

7. Limitations on the number of Class A and Class B Internet *network numbers (netids)* have revealed 32-bit IP addressing to be inadequate to support the future growth of the Internet.
- True
 - False
8. Let A_1 and A_2 be sets. Let T_1 be the task of choosing an element from set A_1 , and T_2 be the task of choosing an element from set A_2 . Therefore, there are $|A_1|$ ways to do T_1 .
- True
 - False
9. Let A_1 and A_2 be sets. Let T_1 be the task of choosing an element from set A_1 , and T_2 be the task of choosing an element from set A_2 . The formula for the union of two sets can be used to determine how many ways you can do both tasks, in any order.
- True
 - False
10. Tree diagrams may be used to solve counting problems.
- True
 - False
11. Using the generalized pigeonhole procedure, if 21 students are placed into 9 classes, then there is at least one class that contains at least _____ student(s).
- 1
 - 2
 - 3
 - 4
12. Applying the pigeonhole principle, with any group of 366 people, at least two must have the same birthday.
- True
 - False
13. Given there are four seasons and 11 public holidays in a year, at least one season must have at least _____ holidays.
- 0
 - 1
 - 2
 - 3

For questions 14 and 15, use the following information:

The Internet uses a datagram protocol. Each datagram contains a header area organized into a maximum of 14 different fields, as well as a data area that contains the actual data being transmitted. One of the 14 header fields is the header length field (HLEN), which is four bits long and indicates the number of 32-bit blocks that compose the header. Another header field is the 16-bit total length (TLEN) field which specifies the length of the entire datagram, including the header and the data areas. The length of the data area may be computed by subtracting HLEN from TLEN.

14. The largest possible value of TLEN determines the maximum total length in octets (blocks of 8 bits) of an Internet datagram. What is this value?
 - a. 2^{16}
 - b. $2^{16} - 1$
 - c. $2^{16} * 2^8$
 - d. $2^{16} - 2^8$

15. The minimum—and most common—value for HLEN is 20 octets. What is the maximum total data area length in octets?
 - a. 65,536
 - b. 65,535
 - c. 65,516
 - d. 65,515

16. Find the number of permutations of the word COEFFICIENT.
 - a. $11!$
 - b. $11! - 4!$
 - c. $11! / 4!$
 - d. $11! / 2!^4$

17. A class consists of 20 seniors and 15 juniors. How many picnic committees of size 5 can be formed?
 - a. $P(20,5)$
 - b. $P(35,5)$
 - c. $C(20,5)$
 - d. $C(35,5)$

18. A class consists of 20 seniors and 15 juniors. How many picnic committees of size 5 can be formed, given that the committee must contain 3 seniors and 2 juniors?
- $P(20,3) * P(15,2)$
 - $P(35,5) - P(20,2)$
 - $C(20,3) * C(15,2)$
 - $C(35,5) - C(20,2)$
19. Pascal's identity is the basis for a geometric arrangement of the binomial coefficients in a triangle.
- True
 - False
20. What is the probability that a card drawn from a deck of ordinary playing cards is an ace?
- 1/52
 - 1/13
 - 4/13
 - 1/4
21. How many different 13-card bridge hands can be dealt from a deck of 52 cards?
- $P(52,13)$
 - $C(52,13)$
 - $52! / 13!$
 - $(52! / 13!) * 39!$
22. A state lottery commission decides to stimulate interest in gambling by increasing the payoff for their "Pick 6" lottery. To accomplish this feat, they decide to double the minimum jackpot from \$1 million to \$2 million and to increase the number of numbers from 1 through 40 to 1 through 42. What is your chance of winning if you buy one ticket?
- 1 / 3,838,380
 - 1 / 5,245,786
 - 1 / 4,496,388
 - 1 / 749,398

23. The permutations of the set $\{1, 2, 3, 4, 5, 6\}$ are arranged in lexicographic order. What is the number following 364125?
- a. 364152
 - b. 364512
 - c. 364521
 - d. 364215
24. The *next bit string* procedure produces the next largest bit string after $b_{n-1}b_{n-2}\dots b_0$ is defined as follows:

```
 $i := 0$   
while  $b_i = 1$   
  begin  
     $b_i := 0$   
     $i := i + 1$   
  end  
 $b_i := 1$ 
```

What is the next largest bit string after 10 0011 1111?

- a. 10 0011 0000
 - b. 10 0101 0000
 - c. 10 0110 0000
 - d. 10 0100 0000 by calculation
25. Find the next largest 4-combination of the set $\{1, 2, 3, 4, 5, 6\}$ after $\{1, 2, 5, 6\}$.
- a. $\{1, 2, 6, 5\}$
 - b. $\{1, 3, 2, 4\}$
 - c. $\{1, 3, 2, 5\}$
 - d. $\{1, 3, 4, 5\}$