You may take this test with you afterwards, but you must fill out your answers on the bubble form and turn it in. This test is worth 10% of your final grade. This test is closed book and closed notes. For the multiple choice problems, select the best answer for each one and select the appropriate letter on your answer sheet. Be careful - more than one answer may seem to be correct. Some questions are tricky. There are 30 questions, each worth 3 points. (Turning in your test is worth 10 points!)

**Multiple Choice (3 points each)**

1. Which of the following cryptographic techniques is considered the most secure?
   - a) Caesar Cipher
   - b) Transposition Cipher
   - c) One-time Pad
   - d) Steganography, using pictures

2. Which of the following is the best example of an algorithm?
   - a) Heading east to get to Lake Michigan
   - b) Polya's problem solving strategy steps
   - c) Following the instruction to "measure twice, cut once."
   - d) A method for sorting a set of numbers

3. Consider both the *picture activity* and the *sandwich making* activities that we did in class. Which of the following provides the best description of the connection between these two activities?
   - a) Words are ambiguous
   - b) Details are important and can affect an outcome of some task
   - c) Representation of data makes a task either easier or more complex.
   - d) We can interpret language differently because we make assumptions

4. In order to do the “mind-reader” trick using number boxes, it is necessary to:
   - a) Know how to count in binary
   - b) Know the place values for the first six binary number positions
   - c) Add or ignore the numbers in the upper-left of each box
   - d) Understand why each number is contained in the particular box it is in

5. What is the biggest number that can be represented in binary using 5 fingers, where a closed fist is zero, and each finger represents a single binary digit 0 or 1?
   - a) 8
   - b) 16
   - c) 32
   - d) 64

6. If you were on the bus counting in binary across the fingers on both hands, which of the following binary numbers would be the most likely to offend some other passenger?
   - a) 2
   - b) 18
   - c) 72
   - d) 132
7. The value 67 in binary is:
   a) 1100001
   b) 1010011
   c) 1100101
   d) 1000011

8. Depending on the context in which it is used, the following binary string could represent:
   01010010
   a) A binary number
   b) An ASCII character value
   c) A hexadecimal number
   d) More than one of the above

9. For the following problem, remember that when using the ASCII code ‘0’ is represented by 48, ‘A’ is 65, and ‘a’ is 97. If you were a detective analyzing a file and you came across the bit string:
   1 0 0 0 0 1 1
   what should you conclude it is?
   a) The value 69
   b) An alphabetic upper-case letter
   c) Part of a picture
   d) The binary code for a single number digit

10. In class we’ve looked at the characteristics of decimal and binary number systems. Taking those same ideas and applying them to quinary (base 5) numbers, what would be the valid digits used in a quinary number?
   a) 1 through 5
   b) 1 through 4
   c) 0 through 4
   d) 0 through 5

11. Think back to the exercise in class where we counted how many students were in the class. Everyone started out as a number 1, then compared with another person standing. In each stage one person became the sum of the two numbers, and the other person sat down. If a set of such comparisons were all done one stage at a time, how many stages would be needed to count 130 people?
   a) 7
   b) 8
   c) 9
   d) 10

12. Consider looking up a word in a 1,000 page dictionary using binary search. How many pages would you need to look at, in the worst case?
   a) 1
   b) 10
   c) 100
   d) It depends on the length of the word
13. Consider our activities and discussion of different methods of sorting. Which of the following is true?
   a) Some methods of sorting are always faster, for all possible orderings of numbers
   b) Some methods of sorting are generally faster than others, but not always
   c) A sorting method that works really well for \( n \) distinct values may not work well at all for \( n+1 \) distinct values
   d) It doesn't matter which kind of sorting is used because computers are so fast these days

14. Adding a zero to the left of a binary number (e.g. changing 110 to 0110) has the following effect:
   a) It adds two to the original number
   b) It doubles the original number
   c) It halves the original number
   d) It doesn't change the original number

15. Adding a zero to the right of a binary number (e.g. changing 110 to 1100) has the following effect:
   e) It adds two to the original number
   f) It doubles the original number
   g) It halves the original number
   h) It doesn't change the original number

16. The problem-solving steps discussed in class were:
   a) Plan, Execute, Evaluate, Refine
   b) Deconstruct, Partition, Evaluate, Execute
   c) Outline, Expand, Create, Evaluate
   d) Implement, Evaluate, Revise, Recreate
   e) Understand, Plan, Implement, Revise

17. What do the twizzler-cutting activity and the lego tower-building activities have in common?
   a) They are examples of the problem-solving process
   b) They illustrate the fact that multiple representations can be used
   c) They are models used to help solve a larger problem
   d) All of the above

18. Which of the following best describes how to always find the best compression using the online text compression tool we used?
   a) At each step substitute for the shortest most commonly repeated adjacent letters
   b) At each step substitute for the longest most commonly repeated adjacent letters
   c) At each step substitute for the most common repeated prefix any length
   d) It is not possible to make a hard-and-fast rule that will always give the best text compression.

19. The video clip of Watson shown in class and discussed illustrates that:
   a) People are smarter than computers
   b) Computers are smarter than people
   c) Computers are faster than humans at solving mathematical patterns
   d) Even though computers are good at some tasks, people are still much better at many others.
   e) A computer can beat a human at a particular task, even if it wouldn’t necessarily pass the Turing Test.
20. Think back to the *parity check* activity we did in class, using a grid of cards, where some were face up and some were face down, and an extra row and extra column of cards were added as parity bits. Consider the following two claims:

   ✓ I. It is possible to *correct* a single card that was flipped over

   ✓ II. It is possible to *detect* the condition where two cards were flipped over, but it is not possible to correct them.

Referring to the above two claims, which of the statements below is correct?

   a) Both I and II are true
   b) I is true, but II is false
   c) I is false, but II is true
   d) Both I and II are false

21. Consider the ASCII table, where the decimal value for ‘A’ is 65, the value for ‘a’ is 97, and the value for ‘0’ is 48. What is the equivalent of the following binary message, where each 7 bits represent a single ASCII character?

   01000010 01000101 01010011 01010100

   a) BEST
   b) YOUS
   c) KEEP
   d) GOIN

22. If a transposition cipher is being used along with potentially reversing the text, what is the translation for the text:

   OHMY

   a) NGLZ
   b) PINX
   c) XLGM
   d) ZNIP

23. Given three bits (e.g. 110), how many additional *parity* bits would we have to add to *detect* a single bit change?

   a) 1
   b) 2
   c) 3
   d) 4

24. Given three bits (e.g. 110), how many additional parity bits would we have to add to *correct* a single bit change?

   a) 1
   b) 2
   c) 3
   d) 4
25. Think back to the “Muddy Town” activity that we explored in class. How many of the following would most likely implement a *minimal spanning tree* that we found for Muddy Town?

- Public Transit System
- Cell phone Network
- UPS delivery route
- Sidewalks on a new university campus

a) 1  
b) 2  
c) 3  
d) 4

26. In Roger Fenton’s photo “The Valley of the Shadow of Death” there were two pictures, one with cannon balls on the road and one without. After many attempts at analysis one was determined to be taken before the other because of:

a) The difference in shadows in the two pictures  
b) Pictures taken at a modern day visit to the same location  
c) Captions from an old newspaper that used the pictures  
d) The difference in the position of rocks on the hillside

27. Consider the in-class example using the toolbox with candies and people on each end of a chain of people, where each person on the end had their own lock. The point of this was:

a) Multiple locks give greater security  
b) Public-key encryption allows two people to establish secure communication  
c) Private encryption allows individuals to have a private conversation  
d) Caesar ciphers with changing rotations are secure

28. The HTML `<br>` tag stands for

a) Branch  
b) Background  
c) Break  
d) Broken

29. At a minimum, in order to be viewable in a browser, an HTML page must have which of the following sets of tags (along with their corresponding closing tags):

a) `<html>`  
b) `<html>` and `<head>`  
c) `<html>` and `<head>` and `<body>`  
d) none of the above

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30. Consider the 0/1 guessing game activity we did in class, as part of the discussion of Artificial Intelligence. What was the point of this exercise?

a) Computers are really smart  
b) Computers can be easily fooled  
c) Computers act smart because they can identify patterns  
d) Computers may be good at some tasks, but lack common sense