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 40 questions, each worth $2\frac{1}{2}$ points.

Multiple Choice (2.5 points each)

1. In the short story "Light of Other Days" the slow glass was described as being "in perfect phase." What did this mean?
   a) Two pieces next to each other would show the same scene
   b) The light leaving one scenedow would enter the other, and visa-versa, magnifying the length of
time of the memory of the glass.
   c) There was little to no distortion of the image coming through.
   d) The seasons captured in the glass matched the seasons outside.

2. Consider the following statements about the sandwich-making activity that we experience in class:
   I. English is ambiguous
   II. Sandwich making is only meaningful within a particular cultural context
   III. Common-sense instructions rely on assumptions
   IV. The success (or not) of a set of sandwich instructions depends on a person's point of view.
   How many of the above statements did we discuss in class as part of this activity?
   a) 1
   b) 2
   c) 3
   d) 4

3. Assume an mp3 audio file takes about 1 MegaByte (MB) per minute. Shakespear's complete works
   have about 3.5 million characters, stored as ASCII text. Which of the following is the most accurate
   statement comparing these two?
   a) Even a one-minute mp3 audio file is larger than the works of Shakespeare.
   b) The works of Shakespeare are larger than a one-minute mp3 audio file
   c) A three-and-a-half minute mp3 audio file takes about the same amount of space as the works of
      Shakespeare
   d) A 35 minute mp3 audio file takes about the same amount of space as the works of Shakespeare.

4. Which of the following is not an example of a one-way function, such as what is used for encryption
   for electronic commerce?
   a) The ice-cream town problem
   b) Dropping a china plate on the floor
   c) Factoring large prime numbers
   d) Writing a computer program
5. Consider the 0/1 number guessing game, played against the computer:

What is the main reason that the computer often wins?

a) After about 15 seconds, most users get careless but the computer program is consistent
b) Since guesses are random, the computer program wins about half of the time
c) The program exploits what it has learned from all previous users
d) The program recognizes patterns in each user's input

6. In the short story "Mimsey were the Borogoves" the technological toys the children were playing with were remarkable primarily because:

a) They incorporated different forms of animation
b) They were from the future
c) They made learning fun
d) They were adaptive

7. Consider the handshakes activity done in class that was the basis for the Scratch handshakes animation assignment. What was the main point of this class activity?

a) Derive the mathematical formula explaining how many handshakes there are relative to \( n \) students.
b) Grapple with how to use a model in problem solving
c) Defining an algorithm that gives consistent results
d) Discovering the idea that the size of data has an impact on which solutions can be used

8. What is the connection between the sandwich making activity done in class and the Twizzler cutting activity. Which of the following provides the best description of the connection between these two activities?

a) A solution can be replicated if there is an algorithm capturing the process.
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

9. What is the connection between the Tower-building activity done in class and the Binary numbers activity. Which of the following provides the best description of the connection between these two activities?

a) Models allow us to analyze small problems and apply what we learn to larger problems
b) Physical objects and drawings can be used as different representations of a problem
c) Different representations can be helpful, but often do not capture all the details of a system
d) Successively doubling the number of items leads to quick growth

10. 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
Use the list of possible answers (A..E) shown at right below for the following set of questions. For each question select which area of study (A..E) is most closely linked with that activity.

11. Sandwich Making

12. 0/1 Number Guessing Game

13. Twizzler Cutting

14. Count Students in the Room

15. Tower Building

16. Ice-cream Town

17. Mind-Reader "Higher / Lower" Number Guessing

18. Consider optimal solutions to the Tower-Building activity that we did in class. How many weeks would it take to build a 16-story tower?
   a) 1-3
   b) 4-5
   c) 6-8
   d) 9+

19. Again consider an optimal solution to the Tower-Building activity that we did in class. How many weeks would it take to build a 50-story tower?
   a) 1-4
   b) 5-7
   c) 8-10
   d) 11+

20. Again consider an optimal solution to the Tower-Building activity that we did in class. How many weeks would it take to build a 100-story tower?
   a) 1-4
   b) 5-7
   c) 8-10
   d) 11+

21. Which of the following sort algorithms that we discussed in class is the slowest on average?
   a) Selection Sort
   b) Insertion Sort
   c) Bubble Sort
   d) Quick Sort
22. Consider the *Muddy City* activity done in class, which could equivalently be represented using the following graph:

What is the minimum length of a solution?

a) 15-17  
b) 18-20  
c) 21-24  
d) 25+

23. Consider the following statements regarding the above *Muddy City* problem:

I. There is only one unique lowest-cost solution  
II. The problem is significantly harder if we are trying to find a minimum cost path where a person visits all the houses.  
III. The problem is significantly harder if we are trying to find a minimum cost path where a person visits all the houses and must end up where they started.

How many of these statements are true?

a) 0  
b) 1  
c) 2  
d) 3

24. Consider creating lines of text on a web page that looks like the following:

All generalizations are false

Aside from the `<html>`, `<head>` and `<body>` tags, how many different types of html tags are needed to give text the above appearance?

a) 3  
b) 4  
c) 5  
d) 6
25. The HTML <br> tag stands for
   a) Branch
   b) Background
   c) Break
   d) Broken

26. Consider the following statements regarding possible places to store a high score value in an App created using App Inventor:
   I. Text Box
   II. Variable
   III. Label
   IV. Button

   How many of these could be used to store the high score value?
   a) 1
   b) 2
   c) 3
   d) 4

27. 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

28. Consider doing the “mind-reader” trick using number boxes:

   To do this 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

29. 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
30. 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

31. 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

32. 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

33. Adding a zero to the right of a binary number (e.g. changing 110 to 1100) 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

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

35. 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.
36. 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

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

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OHMY
```

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

38. 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?

- Electrical Grid
- Cell phone Network
- UPS delivery route
- Sidewalks on a new university campus

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

39. 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

40. 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