

1. What is the role of a prototype program in problem solving?

to show that a certain part of the program works as it is supposed to

2. What stages in the software life cycle are influenced by the testing stage?

coding

3. What are the main advantages associated with object-oriented programming?

existing classes can be reused program maintenance and verification are easier

4. Where do C++ programs begin to execute?

in the "main" function

5. What is a variable?

a location in memory where data can be stored and retrieved

6. Where are variables declared in a C++ program?

anywhere, but where you declare them depends on where you want them to be accessible (their scope)

7. What is the main difference between a while and a do...while statement?

a while loop is pre-check (it checks the condition statement before it executes the code within the while block) a do while loop is post-check (it checks the condition AFTER the block executes, it runs at least once no matter what the condition statement is)

8. What is typically included in a class definition?

functions and data members that belong to the class

9. What is the difference between a data member and a local variable inside a member function?

local variable is only available in the function.

10. What is the difference between a constructor and a function?

a constructor cannot return values, its not even void. it is used to initialize an object's data when it is created. whereas, a function is created to do a specific task, and it can return values.

11. When does C++ create a default constructor?

The compiler will provide one when class does not explicitly include a constructor.

12. How many constructors can be created for a class?

that depends on the number of data members in the class

13. What is the difference between a function prototype and a function definition?

A prototype only declares name, return type, and input type. A definition also defines the scope, variables, process, and return function

14. What is the role of a header-file?

To allow the compiler to recognize the classes when used elsewhere.

15. What does a function signature include?

A function signature includes the name of the function and the types of its arguments

16. What is the scope of global variables?

They can be referenced by any function following their declaration or definition inside the source file.

17. How does the compiler handle inline functions?

it generates a copy of the function's coding which eliminates calling the function

18. What is the main advantage associated with function arguments that are passed by reference?

Passing by reference eliminates the copying of large amounts of data, typical with pass by value.

19. How are overloaded functions differentiated by the compiler?

not answered

20. When defining a recursive function, what are possible causes for infinite recursion?

The recursive problem cannot be reduced to reach the base case.

21. What are the similarities between iteration and recursion?

Both are repetitive and both have a end test.

22. What are the two different ways of specifying the length of an array?

1. Declare the length of the array (int array[10];) 2. Initialize the array (int array[] = {0, 1, 2, 3}; //compiler will assume size of 4)

23. What is the main difference between strings declared using the type string versus strings declared using an array of characters?

type string is an array of chars that will make an array of single letter characters while an array of strings will be an actual array of words (or an array of char arrays)

24. How are arrays passed to functions?

Arrays are passed by reference.

25. What is the difference between an array declared as static, and one that is not?

A program initializes static local arrays when their declarations are first encountered. If a static array is not initialized explicitly by the programmer, each element of that array is initialized to zero by the compiler when the array is created. Non-static array members cannot be initialized at all in C++.

26. How many dimensions need to be specified when passing a multi-dimensional array as an argument to a function?

When passing a multi-dimensional array, all dimensions must be specified except for the first dimension.

27. In one sentence, what is the main idea implemented by insertion sort?

Insertion sort divides the list into sorted and unsorted regions, then takes each item from the unsorted region and inserts it into its correct order in the sorted region.

28. In one sentence, what is the main idea implemented by selection sort?

Finds the minimum value and swap it with the value in the first position.

29. What is the number of operations for insertion sort under a best-case scenario, and what is the best-case scenario?

Best case would be $O(n)$ or $n-1$, because that's what it takes to scan the array and make one swap. The array would then be sorted and would take only 1 operation.

30. What is the base case for a recursive implementation of merge sort?

there is one object in the split array to sort.

31. What is a pointer?

a pointer holds a memory location

32. What does the address (&) operator return?

the ampersand (&) means "pass by reference". When the function is called, a pointer to the variable, instead of the variable itself, will be passed into the function.

33. What does the star (*) operator return?

the star operator returns the value at the memory address the pointer is pointing at.

34. How can an array be addressed in pointer/offset notation?

Takes the number of array elements and points to each at a time

35. What does the sizeof operator return?

the sizeof operator returns the size in bytes of an array parameter

36. What are the different ways to pass a pointer to a function?

Pointers may be passed to functions by value, by reference with reference arguments, or by reference with pointer arguments.

37. What is a function pointer?

it contains the address of the function in memory

38. What is the main advantage of linked lists over arrays?

Elements can be inserted into a link list at any point and does not need to be resized unlike an array needs to be.

39. What is the main advantage of arrays over linked lists?

Arrays are good for random access and good for sequential access which are both in constant time. Where linked lists are linear for random access. Arrays are faster in this case.

40. How are linked lists passed as arguments to a function?

Passed as a pointer to the head.

41. What is the difference between a circular linked list and a basic linked list?

A circular linked list has the last node point back to the head of the linked list.

42. What is the main advantage of a doubly-linked list over a basic linked list?

Doubly linked lists allow backward movement through the nodes.

43. What is the main disadvantage of a doubly-linked list over a basic linked list?

Inserting and deleting in a double-linked list is more involved, and has special cases at the beginning and end.

44. What is a stack?

An abstract data type that stores a set of elements in a particular order.

45. What are the two main functions defined by a stack?

Push and Pop, which add and remove data from the stack, respectively.

46. How can you implement a stack with an array?

you store the stack in the array but you have to keep in mind the first element

47. How can you implement a stack with a list?

using linked list, you are pushing the node that contains each int to the stack until you get to the end of your linked list

48. How are infix expressions evaluated by computers?

Writing arithmetic expressions is called infix notation. This is because a binary operator (like '+') is written in between its two operands (as in "a + b"). There are two alternative forms of notation used in certain situations. One is prefix notation, in which an operator is written before its operands. In prefix notation, the sum of a and b is written "+ a b". This is the notation used to write function calls in mathematics and computer science. It is also used in the Lisp and Scheme programming languages. In postfix notation, an operator is written after its operands. The sum of a and b is written "a b +". (You may have seen this as "reverse Polish notation".) Postfix notation forms the conceptual basis for the way that arithmetic expressions are evaluated by a computer. One important characteristic of both postfix and prefix notations is that they are unambiguous; no parentheses are needed to indicate the order of operations.

49. What is a queue?

a queue is a list of objects in a particular order that is read one at a time starting at the first followed by the second and so on.

50. What are the two main functions defined by a queue?

The two main functions are enqueue and dequeue.

51. How can you implement a queue with an array?

Declare the size of an array, and have special conditional statements (pointers) to make sure you re-use ALL of the array. Say, you have an array of 20 elements, you load up 18, then dequeue 3, when you enqueue 4 more elements, you want to loop back to index 0 and continue from there... this process saves resources.

52. How can you implement a queue with a list?

Utilizing a front pointer and a back pointer. The front pointer and back pointer points to the first item into the queue. As you add items, the front remains the same but the back pointer 'next' points to the new item and the new item is assigned to become the 'new' back pointer.

53. What is the stack operation corresponding to the enqueue operation in queues?

Push operation.

54. What is a tree?

a grouping of data in a parent to child structure

55. What is the height of a tree?

is equal to the number of levels. levels between the root node and the terminal nodes.

56. What is a leaf?

a leaf is a node that has no children nodes

57. What is a binary search tree?

A binary tree where the value in any node n is greater than the value in every node in n 's left subtree, but less than the value of every node in n 's right subtree.

58. What is the inorder traversal of a binary tree?

Inorder traversal of a binary tree will retrieve start at the furthest left hand leaf and checks it, it's parent, and it's right side sibling, then it goes up a level and repeats until it gets to the root.

59. How many comparisons does it take to find an element in a binary search tree?

$\log n$

60. What are the elements typically included in a class definition?

Constructor, functions, and variables native to the class.

61. What are the access-specifiers that can be used in a C++ class definition?

public, private

62. How are objects initialized when they are created?

If you had a class Gradebook, you would initialize it in your main function by use of a constructor in the Gradebook class. If no constructor is specified or found, c++ will use a default one with no parameters.

Gradebook myGradebook; In this bit of code, the class Gradebook has been initialized as object myGradebook.

63. What is a function signature?

A function signature specifies the name and input variables of a function.

64. What is a recursive function?

A recursive function is a function that calls itself repeatedly until a base case is achieved. The fundamental idea is to break one large problem into a series of smaller, similar problems.

65. What is the alternative way to solve a problem that could be solved through recursive functions?

iteration

66. What is the difference between an array that is declared as static and one that is not?

A static array will have a null character at the end of the array.

67. What is the main difference between a string of characters that is read into a variable of type string versus a variable of type char[]?

The difference is that a string that is declared a variable of type char[] is each char is included in the array versus the string of characters that is read into a variable.

68. Briefly describe the divide-and-conquer paradigm.

Break up very large data structures into smaller sub-units, that are easier to manipulate.

69. Briefly describe in one sentence how does merge sort work?

By divide and conquer.

70. What is a pointer?

A pointer is a variable that holds the address of a given variable (and of a given data type)

71. What is the experimental approach for measuring the running time of an algorithm?

The experimental approach for measuring the running time is by using the Big O equation which tells you the running time.

72. Briefly, how does selection sort work?

Selection sort is usually a recursive sorting method where you divide the elements to be sorted in half repeatedly. You then sort the smallest case, then work your way up, sorting each until they are all sorted.

73. What is the advantage of linked lists over arrays?

There is no predetermined length

74. What is a queue?

A queue is like a stack except it follows FIFO (First in first out) .

75. What are the main operations associated with a stack?

push and pop

76. What is the Euler tour traversal of a tree?

The Euler tour traversal of a tree is a specific way of navigating a tree that involves following the tree starting at the very top and moving along the left side of the tree first, cupping in to visit the parents of children nodes. It allows for each node to be visited from the left, the right and the bottom. The Euler tour first progresses to a left child if there is one, then progresses to it's parent, then it's next child, then it's parent's parent.

77. How do you delete a node from a binary search tree?

It all depends on where the node is located. If its a child it can just be deleted but for a node inside the tree it must be replaced with another node that works in its place.

78. How many steps does it take to search a node in a binary search tree?

depending on the way that the tree is ordered, it could be anywhere between $\log(n)$ and N steps.