

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

To find problem and errors in a program before it is finalized

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

Elaboration, Construction, and Transition are all affected by testing

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

Object oriented programming allows programmers to use an object with classes that can be changed and manipulated while not affecting the entire object at once. The classes all hold attributes that affect the object.

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

Int main()

## **5. What is a variable?**

A named object that can hold a numerical or letter value

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

For good programming practice they should be declared before main(), but should at least be declared before they are used.

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

A while loop will check the statement to make sure it is true before executing. A do while loop will execute before checking the statement to see if it should run again.

## **8. What is typically included in a class definition?**

It's specific class name, includes only information defined by that class... implementation details... etc.

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

A local variable cannot be accessed outside the function in which it is declared. Data members normally are private. Variables of functions declared private are accessible only to member functions of the class in which they are declared.

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

A constructor typically used to initialize data members and allocate resources, for instance memory, files, etc. Also a constructor cannot return values. Functions are operations that maybe globally defined.

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

When the class does not explicitly include a constructor.

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

As many as you want so long as they have different parameters.

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

A function definition does not require any additional information that needs to be passed inside its parenthesis to execute. While a definition prototype requires more than one parameters to be passed in order to complete its task.

### **14. What is the difference between a function prototype and a function definition?**

function prototype describes a classes interface without reviling whatever is inside as for the function definition can't do that.

### **15. What is the role of a header-file?**

A header file usually contains class and/or function prototypes.

### **16. What does a function signature include?**

The function name and parameters

### **17. What is the scope of global variables?**

throughout the program

### **18. How does the compiler handle inline functions?**

It generates a copy of the function, if it is needed again.

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

Less overhead than passed by value, especially when using large numbers.

### **20. How are overloaded functions differentiated by the compiler?**

by their function signature

### **21. When defining a recursive function, what are possible causes for infinite recursion?**

improper handling of cases such that not all possible values are able to be handled.

## **22. What are the similarities between iteration and recursion?**

Iteration and recursion both use repetition and perform several simple operations and algorithms successively until they reach a certain limit. So both involve a termination test to find that limit and both slowly approach that termination limit. Both are based on a control statement as well. If coded poorly, both can continue on for ever until the compiler or the computer either locks up, shuts down or halts the operation.

## **23. What are the two different ways of specifying the length of an array?**

Static and dynamic.

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

array of characters can only hold as many characters as the array size and strings are not that limited.

## **25. How are arrays passed to functions?**

Arrays are passed by reference.

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

All elements are initialized to zero if not explicitly initialized, this does not happen for automatic local arrays

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

The size of the first dimension can be omitted, same as a regular array. However, for every dimension outside the first, the size of those dimensions must be specified when passed, for example, a multi-dimensional array of `[2][4][6]` with the name `MultiArray` would be passed as: `"MultiArray[][4][6], 2"`

## **28. In one sentence, what is the main idea implemented by insertion sort?**

Starting at the beginning of an array, take each element in order and place it in its correct position relative to all previously sorted elements.

## **29. In one sentence, what is the main idea implemented by selection sort?**

To sort the elements by comparing two elements and swapping the smaller one to sort the elements in the array.

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

n operations, where n is the number of items.

### **31. What is the base case for a recursive implementation of merge sort?**

Single element in the array

### **32. What is a pointer?**

A pointer is a reference to the memory location of an object.

### **33. What does the address (&) operator return?**

The object's memory address.

### **34. What does the star (\*) operator return?**

synonym for the object its operand points to

### **35. How can an array be addressed in pointer/offset notation?**

$\&[b3]$  is as  $bptr + 3$ . Array can be treated as pointer

### **36. What does the sizeof operator return?**

it returns the size in bytes of a certain variable type

### **37. What is a function pointer?**

A function pointer is a pointer that contains the address of the function in memory.

### **38. What is a linked list?**

A sequence of nodes, each containing data fields (specified by programmer) and pointer(s) which can point to the next or previous nodes.

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

Linked lists are able to grow and shrink in size as needed

### **40. What is the main advantage of arrays over linked lists?**

you can go forwards and backwards and point to any piece of data at any given time where linked lists have to point to the next piece of data.

### **41. How are linked lists passed as arguments to a function?**

By the head of the list. It takes the head address and traverses from there on in.

### **42. What is the difference between a circular linked list and a basic linked list?**

The difference between a circular linked list and a basic linked list is that a circular linked list, the last node references the first node. Every node in a circular linked list has a successor and no node in a circular linked list contains NULL.

### **43. What is the main advantage of a doubly-linked list over a basic linked list?**

A doubly linked list can be traversed either direction, while a normal linked list can only be traversed from start to finish

### **44. What is the main disadvantage of a doubly-linked list over a basic linked list?**

It takes up twice the storage needed.

### **45. What is a stack?**

A storage container that holds objects in a certain order, which has a LIFO priority

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

An array has a fixed size. You can add and delete elements to the end of the array and you use a pointer to keep track of the last element added. Each time you add or delete an element you update the pointer and check if it is equal to the max size of the array.

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

This is the implementation of the stack using single linked list. The operations performed on a stack are 1)push(): This is the function which is for insertion(push)of an element into stack It is similar to the insertion of an element at the end of a single linked list see the function insert\_end() in the program for operations of single linked list 2)pop(): This is the function which is for deletion(popping up) of an element from the stack It is similar to the deletion of an element at the end of a single linked list see the function delete\_end() in the program for operations of single linked list 3)stack\_display():This is the function which is for displaying the elements of a stack

### **48. How are infix expressions evaluated by computers?**

In postfix notation.

### **49. What operations would you need to perform to find a given element on a stack?**

You need to pop each item on the stack and compare the item. Once the item is found, no more items need to be removed.

### **50. What is a queue?**

A queue is similar to an array, except that the data can only be accessed sequentially rather than at random. Unlike a stack, a queue follows FIFO. First in, First out.

### **51. What are the two main functions defined by a queue?**

enqueue and dequeue

## **52. How can you implement a queue with an array?**

add in data from the first element to the last, take out data from the first element to the last.

## **53. How can you implement a queue with a list?**

fairly easy... singly linked list with a pointer to the head and tail of the list. deque first item in queue, create temp pointer to next element, delete head, and then make head the temporary pointer. enqueue new item, use pointer to end of list, add a new item to the next item of the tail, and make the tail the next item of the current tail.

## **54. What is the stack operation corresponding to the enqueue operation in queues?**

push

## **55. What is a tree?**

A Tree is a data structure with one or more data nodes, each of which contains some data. Each node itself can have a number of attached child nodes, creating the branched structure. Trees are named for.

## **56. What is the height of a tree?**

The connections between elements are called branches. Trees are often called inverted trees because they are normally drawn with the root at the top.

## **57. What is a binary tree?**

A tree in which each parent has a maximum of 2 children.

## **58. What is a binary search tree?**

A binary tree with the data organized in a specific arrangement

## **59. What is the inorder traversal of a binary tree?**

It travels left to right

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

$O(\log n)$

## **61. What are the elements typically included in a class definition?**

Class name, {}, semicolon at the end of the definition, private and public followed by ":"

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

functions and data members can be given access-specifications of public, private, and friend. public access is given to any functions or members not given specific access rights.

### **63. How are objects initialized when they are created?**

memory is allocated in accordance with their type and initialization input.

### **64. What is a function signature?**

a function signature should include the name of the function, parameters, and a body.

### **65. What is a recursive function?**

a function that calls itself, and which each call gets closer and closer to the base case.

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

iteration is the alternative way to solve a problem

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

A static array retains any modified values after a function call. Automatic arrays reset to their initial values when the function ends.

### **68. 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[]?**

a string has variable size and function calls available, while a character array usually has a static size.

### **69. Briefly describe the divide-and-conquer paradigm.**

It takes a large problem and splits it into two or more easier or faster solutions, and makes for better readability.

### **70. Briefly describe in one sentence how does merge sort work?**

Merge sort continuously breaks an array in half then sorts the arrays as it concatenates them back together into one sorted array.

### **71. What is a pointer?**

its a data type with a memory address and a value

### **72. What is the experimental approach for measuring the running time of an algorithm?**

the number of times a specific segments get called per unit work.

### **73. Briefly, how does selection sort work?**

It takes the largest item in the unsorted array and swaps it with last item in the unsorted array.

### **74. What is the advantage of linked lists over arrays?**

you can add as many nodes as you like without having to specify a list size, if an array gets too big you have to copy its entire contents to another larger array to get more room

### **75. What is a queue?**

A queue is an abstract data type that is based off of the principle of first in first out. FIFO. The first item inserted into the list will be the first item taken out.

### **76. What are the main operations associated with a stack?**

push and pop

### **77. What is the Euler tour traversal of a tree?**

Euler tour traversal of a tree traverses down each branch straight to one leaf then starts again at the root and repeats until all elements have been traversed.

### **78. How do you delete a node from a binary search tree?**

if the node is a leaf it can simply be deallocated/deleted from memory, and its parent's reference to it changed to NULL. If the node has a single child, the pointer to it should be made to point to its child before deleting the node. Should the node have two children, the easiest solution may be to copy the node's entire subtree to a new array or tree, delete the node and all descendants, then add the elements taken from the subtree back into the main tree.