

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

It is used to let the users have a first idea of the completed program and allow the clients to evaluate the program. This can generate much feedback including software specifications and project estimations of the total project.

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

Refining the solution, Production and Maintenance are all influenced by the Testing stage.

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

Some advantages are existing classes can be reused and program maintenance and verification are easier to accomplish.

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

They begin in the `main()` function.

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

A variable is a location in the computer's memory where a value can be stored for use by a program. Each variable has a name, a value, a type and a size.

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

Variables are declared before they are actually used. They can be declared before `main()` to use globally

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

The termination condition of a do...while statement is usually at the end of the loop so it will run at least once. As for the while statement, if the condition is false to begin with, then the loop will never run.

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

An object and data.

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

Data member are variables that represent an attribute in a class definition. Local variables declared in a function body cannot be used outside of that function body. When a function terminates the values of its local variables are lost.

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

Unlike regular functions, constructors are only used to initialize an object's data when it is created. Constructors must also be given the same name as the class and cannot return any values.

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

during compilation

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

Just one per class.

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

as many as the user decides to use.

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

A function prototype only names the function, its return type, and its argument list, while a definition defines the above as well as what the function actually does.

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

class definitions are placed here

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

the name of the function and its parameters

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

The entire program or file.

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

compiler ignores inline qualifier

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

Gives the called function the ability to access and modify the caller's argument data directly.

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

The number and type of its parameters.

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

not creating a base case, or in the case where the base case will never be met.

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

Many problems can be solved by both iteration and recursion, and either may go into a condition of infinite execution if a termination test is omitted.

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

define it as `array[5]` or `array[1,2,3,4,5]`

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

A char array reads a string as each individual character. A string literal array reads the entire string.

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

Specify array name without brackets. Array size is normally passed as another argument so the function can process the specific number of elements in the array. Arrays are passed by reference. Individual array elements passed by value. Functions that take arrays as arguments.

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

An array that is not declared as static will re-initialize every time the function declaring it is called. A static array will initialize only once, at the declaration, and will store the values in its elements throughout the duration of the program, even if the same function is called multiple times, a static array will only initialize once.

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

Two parameters, the array and how many columns. `array(a[],[3])`

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

Looking at the 2nd element move forward and place the element in the correct spot.

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

Find the lowest unsorted value in the array and place it at the current position (starting at the first element in the array) and advance the "current" position by one.

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

1 operation. the best case scenario is where it is already sorted and does one comparison.

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

A list size of 1, where it is already sorted.

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

A pointer is a reference to a location in memory

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

The memory address of operand, 0x000000 or something along those lines.

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

returns synonym for the object its operand points to

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

First, some pointer variable must reference the first entity in the array. Any variable in the array can then be accessed by referring to that first entity's address plus some offset. i.e. `ptrToArray = array;`  
`nthEntity = *(ptrToArray + n);`

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

total number of bytes in the array

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

A pointer that points to the memory address of the beginning part of a functions. pretty much the pointer points to the function so it can be called to execute.

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

A list of elements, or nodes, that are linked to one another such that each element points to the next element.

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

You can expand when you need it. You do not have to predetermine the size.

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

You don't have to iterate through the entire list to access elements.

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

The linked list object contains the head, through which the other elements are accessible.

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

No Node in a circular linked list contains NULL, the last Node points back to a Node within the list.

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

a doubly linked list has pointers in both directions. this allows for access from back to front as well as front to back

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

1- each node requires an extra pointer, requiring more space 2- the insertion or deletion of a node takes a bit longer, more pointer operations

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

a finite ordered list with zero or more elements

### **46. What are the two main functions defined by a stack?**

push and pop. Push adds a given node to the top of the stack leaving previous nodes below. Pop removes and returns the current top node of the stack

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

You implement a list in which the head pointer points to the element most recently pushed onto the list and the pop function changes the head pointer to point to the next to last element in the list and removes the element head pointer previously pointed to.

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

By using parentheses to have order in the expression.

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

if the stack is implemented using an array you could simply search the array for the item. If the stack is implemented using a linked list you would have to pop the values off of the stack until either the value is found or the stack is empty, you would then have to have the items put back into the list.

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

A waiting list of items that operation in a FIFO (first in first out) order.

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

enqueue and dequeue.

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

By using the beginning of the array as the removal point of the queue (or beginning of the queue) and the  $i$ th element as the end of the queue.

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

You create a list of nodes that had a head and a top pointer, and the functions are basically the same substituting pop and push with enqueue and dequeue

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

push

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

a set of data arranged with pointers. each element can have many pointers, but no two pointers point to the same element

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

the height of a tree is how many levels of nodes that it has

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

A set of zero or more nodes, partitioned into a root node and two possibly empty sets that are binary trees. Thus, each node in a binary tree has at most two children, the left child and the right child.

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

it is a binary tree where each node has a value, a total order is defined on these values, the left subtree of a node contains only values less than the node's value, and the right subtree of a node contains only values greater than or equal to the node's value.

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

starting by displaying the node furthest to the right, then the node, then the node on the right, in recursive order.

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

At most it takes one less comparisons than the tree's height. In big-O notation it takes  $O(\log n)$  comparisons if the tree is balanced.

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

A class definition includes the definitions of the class' constructor(s) and any public or private functions. Of course, it also #includes the class header and any necessary C libraries

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

public, private, protected

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

they are initialized to a value dependent on the compiler

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

is the name of the function, return type, and parameters that are being used

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

a function that calls on itself and uses a base case to stop the recursion

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

Iteration.

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

a non static array must reinitialize itself every function call, while a static array will only initialize itself once, unless otherwise forced.

### **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[]?**

the one that is type string has an extra string member. The /0 at the end.

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

Divide-and-conquer refers to abstraction, the act of separating large, complex problems into smaller, easier problems that can be solved by a relatively simple algorithm.

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

Merge sort recursively divides an array into two arrays until all arrays have 1 element, at which point it merges the 1 element arrays into larger sorted arrays, the final returned array being the sorted version of the initial array.

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

A pointer is a variable that contains a memory address for something that you can use, such as a value, array, or even a function.

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

to run the program through and see how many times each thing is called and the runtime of each function is based on that.

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

pick a number, and set all values less than that number to the left, while all numbers on the right of that number is larger.

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

They grow dynamically, unlike the fixed size array

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

a list of objects that follow the rule first in first out, essentially a linked list that goes in order of the first object in the list is the first to be taken off.

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

The main operations in a stack are push and pop. Push adds an item to the top of the stack, pop removes the top item from the stack.

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

An Euler traversal is a traversal that begins with the root, and travels around the outside of the tree. Each element in the tree is visited 3 times. From the left, from the bottom and from the right.

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

if the node is a leaf, you set it's parent's pointer to null. if the node is in the tree you must replace the node with one in the tree: either the largest in the left of the tree or the smallest in the right of the tree. this can be done recursively if needed.