

WYSE – Academic Challenge
Computer Science Test (Sectional) – 2016

1. **Correct Answer: A**

Answer A attempts to use the private element age outside of the class causing an error. Answer C uses the pointer/array without the arrow operator or the [] causing an error. Answer D does not pass an element into the method setAge, also the method setAge is void and not compatible for use with the equal and the int 17. The getName method is missing its () for answer E. Answer B while looking incorrect with the parameter -1, is valid. The method will use the ternary operator ?: to check the age and since it is negative will set it to the default value of 10;

2. **Correct Answer: C**

All 10 items in the list are constructed with the values Default for name and 1 for age. The loop sets the ages to 5,6,7,...,14 for the 10 elements in the list in that order. The sixth item in the list, which is element list[5] will have Default for the name and 11 for the age.

3. **Correct Answer: A**

The methods on the lines are set and get methods that are used to implement the principal of encapsulation for the class. Encapsulation refers to “hiding” the data behind methods. The set methods will not allow for improper values of the data to be set and the get methods will not allow the programmer to change the data at all.

4. **Correct Answer: E**

The queue has the order of elements dependent upon when they are added to the list. Enqueue adds items to the front and dequeue removes them from the back to implement the first in first out property of the queue. Queues may be implemented with arrays or linked lists, but those implemented with arrays may become full and at that point will not be able to accept more elements. An associative array will use the data of the object itself to determine its place in the list, not the order in which the object was added, so it is not appropriate for implementing a queue structure.

5. **Correct Answer: B**

The operations are traced below.

PUSH A;	A
PUSH B;	AB
PUSH G;	ABG
POP;	AB
PUSH A;	ABA
POP;	AB
PUSH D;	ABD
PUSH A;	ABDA

6. Correct Answer: E

The algorithm will execute n times for the first loop, n times for the second and n for the third, so the complexity is BigO of n cubed.

7. Correct Answer: C

This tree has three nodes without any children, which are leaves. In a binary tree, nodes can only have a maximum of two children. In this binary tree, the node L is to the right of node S, so it is not a binary search tree. If node L were to branch to the left of node M, it would be. The depth of the tree, or the longest path from the root to the farthest leaf is three. The parent of nodes M and Z is indeed S.

8. Correct Answer: C

$$\begin{aligned} 310 &= 3 \cdot 16^2 + 1 \cdot 16^1 + 0 \cdot 16^0 \\ &= 3 \cdot 256 + 16 \\ &= 784 \end{aligned}$$

9. Correct Answer: D

(A xor B)' or ABC
(T xor F)' or TFC
(T)' or TFC
F or TFC
TFC
F

replace the values for A and B
True xor False is True
True not is F
Anything Ored with F is itself
Anything ANDed with F is F

10. Correct Answer: E

All are used.

One's Complement requires that bits are swapped for negatives.

Signed magnitude just adds one sign bit to indicate a negative number.

Two's Complement has the most significant bit carry a magnitude that is negative to obtain negative numbers.

Biased numbers treat all bits as positive, but subtract a known bias from the final result to obtain negatives.

Both One's Complement and Signed Magnitude actually have two ways to represent zero.

11. Correct Answer: D

Both truth tables and Karnaugh maps (Kmaps) will have $2^{(\text{inputs})} = \text{number of outputs}$ for complete tables or maps due to the nature of each bit. So a function with 3 inputs will have $2^3 = 8$ outputs and one with 4 inputs will have $2^4=16$ outputs. Kmaps are used to find the minimal sum of product expression which can be implemented with just NAND gates due to the use DeMorgan's Law. Kmaps however may often, but not always, have more than one optimal minimal expression.

Note the example on the right. The yellow boxes must be shaded and yield (AD). The blue boxes must be shaded and yield (A'D'). Now, there are two ways to cover the last two 1's: the column (C'D) or the box (A'C'). So there is no one unique minimal expression.
 AD OR A'D' OR C'D
 AD OR A'D' OR A'C'
 Either expression above will work.

	C'D' 00	C'D 01	CD 11	CD' 10
A'B' 00	1	1	0	1
A'B 01	1	1	0	1
AB 11	0	1	1	0
AB' 10	0	1	1	0

12. Correct Answer: A

Protocol is the correct answer.
 Headers and trailers are used by various protocols to encapsulate data.
 Checksums and CRCs are used for error detection in data communications.

13. Correct Answer: B

A 64-bit computer can access eight 8-bit bytes at a time.

14. Correct Answer: A

A TCP/IP address has 32 bits and is divided into 4 octets. Depending on the value of the first octet, there can be 8 network bits and 24 host bits, 16 network bits and 16 host bits, or 24 host bits and 8 network bits. Regardless of the number, the value of the each of the host bits will always be 1 for a broadcast address.

15. Correct Answer: D

A denial of service attack attempts to slow down or stop a computer system or network by flooding a computer or network with requests for information and data.
 A Trojan horse is a malicious program that disguises itself as something else.
 A virus is a malicious program that spreads by attaching itself to legitimate files.
 A worm is a malicious program that spreads by replicating itself over and over.
 Social engineering is a non-technical means that hackers use to gain access to a system.

16. Correct Answer: E

A unary operator requires just one single operand.

The logical not, !, pre/post increment, ++, and pre/post decrement, --, are all unary operators.

The – sign exhibits polymorphic behavior. When used as subtraction, it is a binary operator. When used as negation, it is a unary operator.

If the question had been worded, “Which of the following is not a unary operator?” it would have had the same answer, but been a bit trickier. However, the wording “cannot behave as” was intended to provide a clue that the answer was not that obvious.

17. Correct Answer: C

The flowchart depicts a post-test loop, which means that the statements within the loop will be executed at least once and then the loop condition is checked. Both the for loop and the while loop are pretest loops, which means that the loop condition is checked first and the statements within the loop may never be executed.

18. Correct Answer: B

Pass by value takes the input argument, copies it and passes it onto the function. Pass by reference insures that the variable (b in the case of func2) is pointing to the same object that is used as the input. The & indicates that it is a pass by reference. Pass by reference can be quicker than using pass by value because a new object is not created. Pass by reference also allows the function to change the item that was passed in. Lastly, when passing arrays into a function, they are always passed by reference so that they do not need to be recreated for the function, again saving time.

19. Correct Answer: C

Because the second function uses pass by reference on the second element, a variable must be used as the input argument, not a value.

20. Correct Answer: A

A trace of the code follows.

	Where	MAIN	func1 vars	func2 vars	
		a	a b c	a b c	
a=func1(2,2)	main	?	2 2 ?	NOTE 1	
int c = 2;	func1	?	2 2 2		
a += c++;	func1	?	4 2 2		
	func1	?	4 2 3		
return a+b	func1	6	NOTE 2		
cout<<func2(2, a);	main	6		2 6 ?	NOTE
3					
int c = 2;	func2	6		2 6 2	
a += ++c;	func2			2 6 3	
	func2			5 6 3	
return a+b;	func2				
Return 11					
cout<<func2(a, c);	main	Display 11			

NOTE 1: Items from func2 are not in scope yet.

NOTE 2: Items from func1 have lost scope and have been discarded.

NOTE 3: func2(a,c) must finish executing before the cout can execute.

21. Correct Answer: D

The trace follows. Note that due to the value of c being static, the value does not lose scope between the calls and carries the value into the second call.

	Where	MAIN	*func3 vars	**func3 vars
		a b c	a b c	a b c
cout<<func3(a,b);	main	5 2 10	5 2 ?	
static int c = 2;	func3	5 2 10	5 2 2	
a += ++c;	func3	5 2 10	5 2 3	
	func3	5 2 10	8 2 3	
return a+b;	func3	5 2 10	8 2 3	
cout<<func3(a,b);	main	5 2 10		3
Displays 10				
cout<< func3(b,b);	main	5 2 10		2 2 3
static int c = 2;	func3	5 2 10		2 2 3
NOTE 1				
a += ++c;	func3	5 2 10		2 2 4
	func3	5 2 10		6 2 4
return a+b;	func3	5 2 10		6 2 4
cout<< func3(b,b);	main	5 2 10		4
Displays 8				

*First call to func3

**Second call to func3

NOTE 1: This is skipped on second call of function.

22. Correct Answer: C

See the code trace below:

Line # of Code	Statement	x	n	xx	i	funA(x)
12	int x = 3;	3	--	--	--	--
13	cout << funA(x);	3				
1	int funA(int n)	--	3	--	--	--
3	int xx = 1;	--	3	1	--	--
4	for(int i = 0; i < n; i++)	--	3	1	0	--
5	xx += n;	--	3	4	0	--
4	for(int i = 0; i < n; i++)	--	3	4	1	--
5	xx += n;	--	3	7	1	--
4	for(int i = 0; i < n; i++)	--	3	7	2	--
5	xx += n;	--	3	10	2	--
4	for(int i = 0; i < n; i++)	--	3	10	3	--
6	if (xx < 3 xx > 10)	--	3	10	3	--
9	return xx + n;	--	3	10	3	--
13	cout << funA(x);	3	--	--	--	13

23. Correct Answer: A

|| is the or operator in C++
 && is the and operator in C++
 ! is the not operator in C++
 C++ does not have a xor or a true operator

24. Correct Answer: B

If the || operator were replaced with the && operator, the statement would be:

```
if (xx < 3 && xx > 10)
```

The && operator is the and operator. As a number cannot be less than 3 and greater than 10, the else path of the if statement (line 9) would always be executed, regardless of any values passed into funA.

25. Correct Answer: A

pstr[2][2]; points to the third letter of the third entry in the array, which is the d in Wednesday.

26. Correct Answer: B

pstr[1] points to the string Tuesday, which will be output.

27. Correct Answer: D

The sizeof operators return the number of bytes in the operand. Given the following code:

```
int x;  
cout << sizeof(x);
```

The output of the `cout` statement would be 4, the number of bytes in an integer.

28. Correct Answer: B

If a user were to input the number 4, the `case 4:` path in the `switch` statement would be selected.

29. Correct Answer: E

The switch statement has case paths for 1, 2, 3, & 4. The default path will be executed if the user input is not one of those choices.

30. Correct Answer: D

Like an if statement, the switch statement is a selection.
For and while statements are loops and repetition.
A sequence logic structure is simply one statement executed after another.