

**WYSE – Academic Challenge
Computer Science Test (State) – 2014
Solution Set**

1. Correct Answer: D

SOLUTION:

Authentication involves verifying the user that will gain access to a system. The most common form of authentication is the use of the password and username, however other methods may be used such as biometric data. The password and username exchange is most commonly encrypted so that others may not gain access to the password, however encryption itself is not the main focus of authentication.

2. Correct Answer: C

SOLUTION:

- a. This is the definition for virtual memory. Virtual memory is hard drive space that is formatted differently than the regular file system and is not directly accessible by a user or application programs. The operating system uses virtual memory to store seldom used portions of an application that would otherwise be stored in RAM. This allows the computer to run more applications simultaneously than it could if the whole of each application needed to remain in RAM.
- b. This is the definition for ROM. ROM, Read Only Memory, is non-volatile electronic memory that cannot be altered. It is used for code that will not change on the system such as the BIOS.
- c. Correct answer. Cache memory provides a high speed buffer between the CPU and memory. The cache is often on the CPU die and the system does not need to use the system bus to access data on the cache as it does need to do for RAM. As a result, cache is even faster than RAM.
- d. This is the definition for flash memory. Flash memory is an electronic computer storage device that can be electrically erased and reprogrammed. Flash memory is also non-volatile. Flash memory is commonly used in thumb drives and SD cards. Flash memory is also being used as a replacement for the traditional hard drive.
- e. Nonsensical

3. Correct Answer: B

SOLUTION:

- a. This is what a port does. A port is a socket for external devices to connect to the system unit. Some ports connect directly to the system board, while others connect to cards that are inserted into slots on the system board. Ports such as network, video, and USB are standard on most computers.
- b. Correct answer. Bus lines, also known as buses, provide data pathways that connect various system components. Bus width is the number of bits that can travel simultaneously. A system bus connects the CPU to RAM.
- c. This is what an expansion bus does. An expansion bus is similar to the system bus, but it connects the CPU to other slots on the computer. A typical expansion bus that is included on most computers is the Universal Serial Bus (USB).
- d. This is what the power supply does. Computers require direct current (DC) to power their electronic components. DC power can be provided indirectly by converting alternating current (AC) from standard wall outlets or directly from batteries. Desktop computers have a power supply unit located within the system unit which plugs into a standard wall outlet and converts

AC to DC. Notebooks and tablets use batteries. To charge the batteries, AC adapters are typically located outside the system unit.

- e. This is what memory does. Memory holds data, instructions, and information and uses three types of chips to do this. The three types are RAM, ROM, and flash.

4. Correct Answer: D

SOLUTION:

Disk fragments occur as a normal part of computer operations. Ideally, files are stored on contiguous sectors. When this is not possible, the file becomes fragmented, which can negatively impact performance. A disk defragmenter locates and eliminates unnecessary fragments and it rearranges files and unused disk space to optimize operations. The Windows operating system provides a disk defragmenter.

5. Correct Answer: E

SOLUTION:

$$\begin{aligned} A3.8 &= 10*16^1 + 3*16^0 + 8*16^{-1} \\ &= 160 + 3 + 0.5 \end{aligned}$$

6. Correct Answer: D

SOLUTION:

Base 7 numbers increase by a power of 7 for every new digit, just as decimal increases by a power of 10 for each new digit or binary increases by a power of 2 for each new digit.

$$\begin{aligned} 64 &= 6*7^1 + 4*7^0 \\ &= 42 + 4 \\ &= 46 \end{aligned}$$

7. Correct Answer: B

SOLUTION:

The values of length, width and height are all incremented for the Box and then the Box itself is returned after it has been modified so that it may be used. So the item is changed before it is used, making it a pre-increment operator.

8. Correct Answer: C

SOLUTION:

The getArea method is first described in the base Rectangle class, but it is overridden in the derived Box class. Because Box does inherit the Rectangle methods, it could use the original getArea from Rectangle, but in order to have it work appropriately, it must override the original method. Unlike overloaded functions which must not share the same parameter settings, overridden methods in a class may have the exact same parameters. The compiler will chose the method that matches most closely to the class making the call.

9. Correct Answer: D

SOLUTION:

Now that the items in Rectangle are private, Box cannot directly access them. So the methods that use width and length directly without using the appropriate set and get methods would not work. getHeight and setHeight would still work as height is not part of the Rectangle class.

10. Correct Answer: E

SOLUTION:

Two rectangle constructors are called, one for a and one for b. The array of 3 Boxes requires 3 Rectangle constructors to be called and 3 Box constructors. The order of the constructors would be as follows.

Rectangle constructor for a

Rectangle constructor for b

Rectangle constructor for c[0]

Box constructor for c[0]

Rectangle constructor for c[1]

Box constructor for c[1]

Rectangle constructor for c[2]

Box constructor for c[2]

11. Correct Answer: E

SOLUTION:

Trees must not contain any loops and the edges AD, DC, CE, EA form a loop. The minimal spanning tree for this 6 node, connected graph will contain 5 edges that total the least cost. The node AF will not be included as it has the highest cost to get to both A and F. The least cost 5 edges that do not form a loop are BF, AD, CD, CE and AB. This is the only minimal spanning tree for this graph, but for some graphs, it is possible to have more than one minimal spanning tree, especially where many edges of similar cost exist.

12. Correct Answer: B

SOLUTION:

A search will just examine a list without changing it, while sorts will rearrange the contents of the list.

13. Correct Answer: A

SOLUTION:

The third segment uses the dot operator instead of the arrow operator, which is a syntax error. The fourth example fails to address the data element when assigning the data value of 3. The second example does assign the head->next value to curNode, but does so before it assigns the item it is pointing at to curNode->next, which causes curNode->next to point to itself and the loss of the rest of the list. The first example is correct.

14. Correct Answer: D

SOLUTION:

The equivalent expression is given below.

$(A \text{ xor } B) \text{ or } (CA)'$

$(\text{True xor } B) \text{ or } (\text{True True})'$ Substitute in the values of C and A.

$(\text{True xor } B) \text{ or } \text{False}$ Simplify the negative of True.

$\text{True xor } B$ Anything that is or'ed with False is itself.

B' For xor to be true, the values must be opposite.

15. Correct Answer: E

SOLUTION:

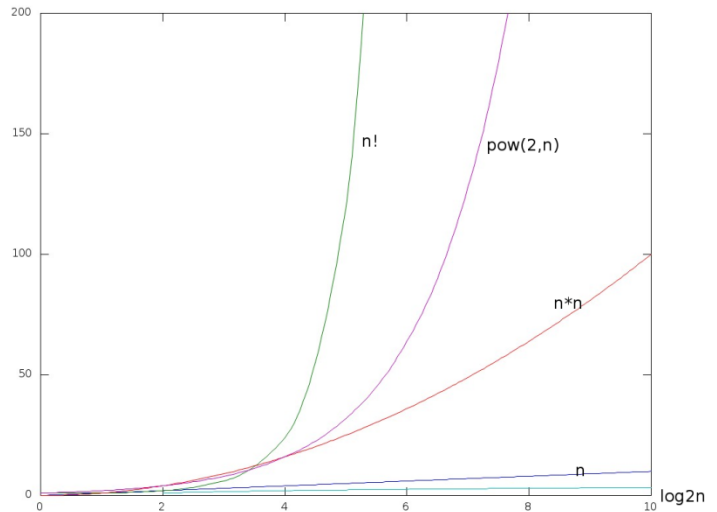
Answers A, D and E are all equivalent logically, however only E is minimal. The minimal expression should include the least amount of terms, which would be easier to implement or build with actual logic gates. Answer B includes one false cell and answer C fails to include one of the true cells. The bolded terms implement $C'D'$, the italicized terms implement $A'D'$ and the underlined terms implement the four corners of the K-map $B'D'$.

	A'B'	A'B	AB	AB'
C'D'	<u><i>I</i></u>	<i>T</i>	<i>T</i>	<u><i>I</i></u>
C'D	F	F	F	F
CD	F	F	F	F
CD'	<u><i>I</i></u>	<i>T</i>	F	<u><i>I</i></u>

16. Correct Answer: C

SOLUTION:

Logarithms grow the slowest, exponential functions grow faster than squared or cubed functions, while the factorial will grow even faster than all of the functions specified. Inductive proofs are helpful in verifying this.



17. Correct Answer: C

SOLUTION:

Dynamically allocated memory is useful for creating data structures that will grow to fit the size of the data required during program execution. It is created while the program is executed, unlike standard variable declarations which have their memory allocated at the time that the program is loaded into memory to prepare for execution. Dynamically allocated memory may be deallocated using the delete command in C++ and the free command in standard C.

18. Correct Answer: B

SOLUTION:

The key to understanding this program is the use of the static variable `zz` in `myfunc`. Unlike most variables declared in a function, a static variable retains its value from one call to the next. The purpose of `myfunc` is to add a parameter `xx` to an accumulator `zz` `yy` times. `myfunc` then returns the value of `zz` to the calling program. As `zz` is declared as static, it retains its value from the previous call and accumulates a new, bigger total (assuming positive numbers) on each subsequent call. The first call to `myfunc` passed in 4 and 2. `myfunc` will add 4 to `zz` twice, which results in `zz = 8`. The second call passes in 2 and 2 to `myfunc`. This will add 2 to `zz` twice, resulting in 12. If static was removed from line 2, `zz` would be 0 each time `myfunc` was called and the second call would result in `zz` being set to 4.

19. Correct Answer: A

SOLUTION:

See solution for Question 18.

20. Correct Answer: C

SOLUTION:

- a. Functions may or may not contain function calls, but the presence or absence of such does not relate to them being overloaded.
- b. Any function may have a prototype.
- c. Correct answer.
- d. Any function may call another that is within its scope.

21. Correct Answer: D

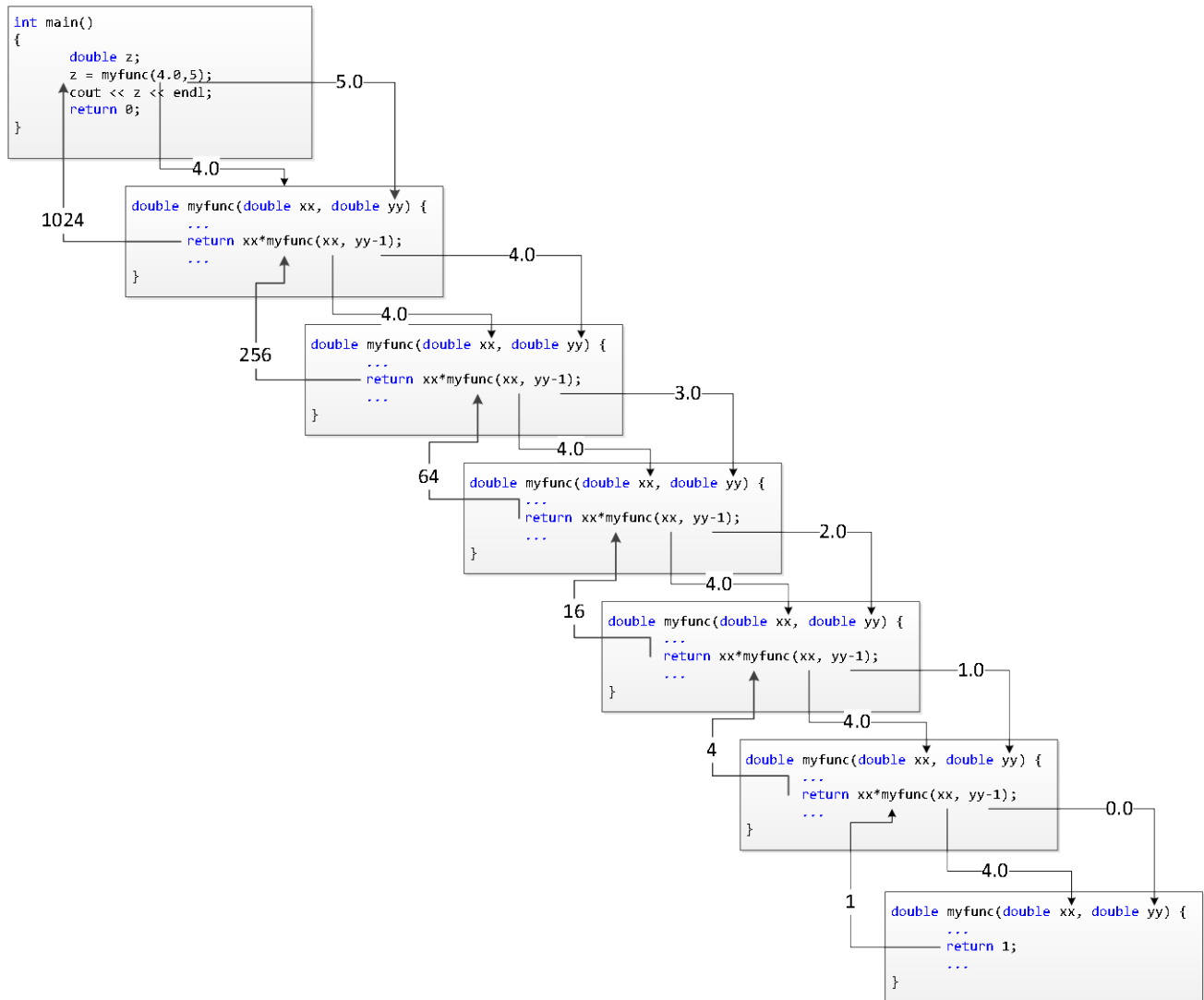
SOLUTION:

A function that has a call to itself—that call is commonly referred to as a recursive call.

22. Correct Answer: E

SOLUTION:

The below diagram shows the recursive calls to myfunc, the values of the parameters, and the returned value from each call.



23. Correct Answer: A

SOLUTION:

The base case of a recursive function is a trivial return, e.g. a return without a recursive call. In this case, when $yy = 0$, the base case is executed `return 1`.

24. Correct Answer: E

SOLUTION:

Line 19 will execute when a throw statement throws an exception of the type `char[]`. In this case, that would be line 11. Line 11 will execute when the user input is > 20 .

25. Correct Answer: A

SOLUTION:

The try-catch block is within the while loop. After the catch executes, the next statement in the while loop will execute. In this case, the catch is the last thing in the while loop and `ch` is still equal to `y`. As a

result, the next thing to be output to stdout will be `Enter a number:` from line 7, the first line of the while loop.

26. Correct Answer: A

SOLUTION:

In this case, the inner try block does not have a handler for an exception of type `int`. Therefore, any exception of type `int` will be caught by the catch block that starts on line 23. For this problem, the `int` exception is thrown by line 13, which will be executed if the user input is `< 10`.

27. Correct Answer: C

SOLUTION:

The ellipsis mean that the catch block will catch any exception that has not already been caught by a previous catch block. A catch block with ellipsis must be the last catch block associated with a try statement.

28. Correct Answer: C

SOLUTION:

The purpose of `myfunc` is to remove spaces from a character array. The assignment statement in the while condition copies the character from position `j` in the array to position `i`. `j` is incremented every time and `i` is only incremented when the character is not a space, which will result in the spaces being overwritten.

29. Correct Answer: B

SOLUTION:

The `\0` is the null character and terminates a character array.

30. Correct Answer: A

SOLUTION:

In this case, no spaces need to be removed, so the original string will be output.