

WYSE – Academic Challenge  
Computer Science Test (State) – 2012  
**Solution Set**

**1. Correct Answer: B.**

The aspect ratio is the fractional relation of the width of the display area compared to its height.

**2. Correct Answer: C.**

- a – A table does not have a unique identifier.
- b – Every record within a table will have a primary key.
- c – Correct – a primary key uniquely identifies a record (or tuple) with a table.
- d – A primary key cannot be null.
- e – There is a correct answer, D.

**3. Correct Answer: E.**

Geotagging is the process which adds geographical metadata to an object such as a photo, movie, SMS message, website, etc.

**4. Correct Answer: B.**

Dijkstra's algorithm is the basis for the Open Shortest Path First network routing protocol which determines the shortest path between two network nodes.

**5. Correct Answer: C.**

$$\begin{aligned}
 10010101 &= 1 \cdot 2^7 + 0 \cdot 2^6 + 0 \cdot 2^5 + 1 \cdot 2^4 + 0 \cdot 2^3 + 1 \cdot 2^2 + 0 \cdot 2^1 + 1 \cdot 2^0 \\
 &= 128 + 16 + 4 + 1 \\
 &= 149 \\
 149 - 127 &= 22 \quad (-127 \text{ is the bias.})
 \end{aligned}$$

**6. Correct Answer: C.**

The yellow shaded area is A'C.  
The pink shaded area is AC'.  
The remaining two true squares can be covered by taking using the column AB' or the square that overlaps boundary (B'C).  
So two correct answers actually exist, however only the one using AB' is provided. Note also that while d) does represent the function, it does not do so minimally.

	A'B'	A'B	AB	AB'
C'D'	F	F	T	T
C'D	F	F	T	T
CD	T	T	F	T
CD'	T	T	F	T

**7. Correct Answer: E.**

$$\begin{aligned}
 A7.4 &= 10 \cdot 16^1 + 7 \cdot 16^0 + 4 \cdot 16^{-1} \\
 &= 160 + 7 + 0.25 \\
 &= 167.25
 \end{aligned}$$

**8. Correct Answer: E.**

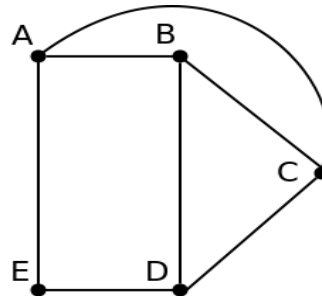
$(A \text{ XOR } B) \text{ OR } (BC)'$   
 $(A \text{ XOR } \text{TRUE}) \text{ OR } ((\text{TRUE})C)'$   
 $A' \text{ OR } ((\text{TRUE})C)'$   
 $A' \text{ OR } C'$   
 $(AC)'$

Rewrite the circuit as a function.  
 Replace B with TRUE.  
 $A \text{ XOR } \text{TRUE}$  is only TRUE when A is FALSE  
 $C \text{ AND } \text{TRUE} = C$   
 DeMorgan's Law

**9. Correct Answer: A.**

An adjacency matrix will have a 1 to indicate a path exists between two vertices and a 0 if there is no path. As there are no loops (direct paths with one edge that circles back to a given node), the diagonal should be zeros, which eliminates b, c and d. As none of the paths are directional, the matrix must be symmetric, which additionally eliminates b.

$$\begin{bmatrix} 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 \end{bmatrix}$$



**10. Correct Answer: D.**

A post-order traversal visits the left node, the right node, then itself.

Start at M, go left to F, go left to A	(A)
Backtrack to F, go right to K, then left to H	(AH)
Backtrack to K, right to L	(AHL)
Backtrack to K	(AHLK)
Backtrack to F	(AHLKF)
Backtrack to M, go right to T, left to Q, no left go right to R	(AHLKFR)
Backtrack to Q	(AHLKFRQ)
Backtrack to T, no right	(AHLKFRQT)
Backtrack to M	(AHLKFRQTM)

**11. Correct Answer: A.**

The part of the function that grows the largest is  $n^2$ . This function dominates or grows faster than the other terms as  $n$  gets larger.

**12. Correct Answer: E.**

Items enqueued (entering) are put at the end of the line, those dequeued (removed) are taken from the front of the line. This First In, First Out structure (FIFO) can use lists or arrays. However, items can only enter or leave from a specific part of the list.

**13. Correct Answer: A.**

The base case of a recursive function is the condition that stops the function from calling itself. In this case the base case is:

```
if ((m % n) == 0)
    return n;
```

So, when  $m$  is divisible by  $n$  without a remainder,  $n$  is returned.

**14. Correct Answer: A.**

The first call, `func(240, 33)` calls `func(33, 9)`.

The second call, `func(33, 9)` calls `func(9, 6)`.

The third call, `func(9, 6)` calls `func(6, 3)`.

The fourth and final call, `func(6, 3)` is a base case.

This is a total of 4 calls to the function.

**15. Correct Answer: B.**

This classic algorithm, known as Euclid's algorithm, computes the greatest common divisor of the two numbers.

**16. Correct Answer: D.**

A trace of the code follows.

prin	loanValue	rate	totPaid	payment	months	
1000	?	.12	?	500	?	
1000	?	.12	?	500	0	
1000	1000	.12	?	500	0	
1000	1000	.12	0	500	0	
1000	1000	.12	500	500	0	start loop
1000	510	.12	500	500	0	
1000	510	.12	500	500	1	
1000	510	.12	1000	500	1	check loop again
1000	15.1	.12	1000	500	1	
1000	15.1	.12	1000	500	2	
1000	15.1	.12	1015.1	500	2	loop stopped
1000	15.1	.12	1015.251	500	3	

**17. Correct Answer: E.**

`months` is not an argument at all, but is returned, which eliminates answer c and d. `prin`, `rate`, `totPaid` are passed by value. The argument `payment` is passed with the `&` which passes the reference of the variable at that location in the argument list. So, `prin`, `rate`, and `payment` are passed by value and `totPaid` is passed by reference. Note that you may not place a value in this location, but rather a variable.

**18. Correct Answer: E.**

For this function call,  $1000 * .12 / 12 = 10 > 5$ , so the loan can never be paid off and -1 is returned.

**19. Correct Answer: B.**

In this case, << is a bitwise operator. It is the left shift operator. It will move the bits in the variable on the left side of the operator to the left. The variable on the right side of the operator determines how many places to the left the bits are moved.

**20. Correct Answer: D.**

i	starting value of m		value of m after shift of i places	
	decimal	binary	decimal	binary
0	1	00000001	1	00000001
1	1	00000001	2	00000010
2	2	00000010	8	00001000
3	8	00001000	64	01000000

Shifting a number one bit to the left is essentially the same as multiplying the integer by two. If a number is shifted two bits to the left, it is the same as multiplying it by four ( $2^2$ ). Shifting three bits is the same as multiplying by eight ( $2^3$ ).

Code trace for 21-23

main	my_func			main	
i	a	b	c	i	j
0	20	<b>5</b>	38	5	5
1	5	38	<b>19</b>	19	19
2	<b>38</b>	19	4	38	38
3	19	<b>4</b>	53	4	4
4	4	53	<b>67</b>	67	67
5	53	67	<b>4</b>	4	4

**21. Correct Answer: D.**

&& is the logical AND operator.

**22. Correct Answer: B.**

See above code trace. Line 4 is only executed once, when the main variable i is 2.

**23. Correct Answer: A.**

See above code trace. The value of j on line 16 is 4.

**24. Correct Answer: B.**

student is derived from person meaning student IS-A person.

**25. Correct Answer: C.**

```
person p[2];           // instantiates an array of two people
student s;            // instantiates a single student
```

Three items are instantiated, each calling default constructors. The first one creates two people, so two default constructors are called for person. By default, each person is 20 years old with a name of DEFAULT NAME. Since the student is also a person, the default person constructor is first called for the student and then the default student constructor is called. The default student will then also be 20 years old with a DEFAULT NAME. The default student constructor will have a major of UNDECIDED. A total of four constructors is called.

**26. Correct Answer: B.**

Answer a is illegal, `person` is a class, not an object.

Answer b is legal.

Answer c is illegal because `s` has no access to `getAge` as protected inheritance was used.

Answer d is illegal as `name` is private.

**27. Correct Answer: D.**

See the explanation from 25 on how the constructors set the values of name, age and major.

**28. Correct Answer: A.**

`float` is used to explicitly type cast an integer value (`a*a`) to a float.

i	i % 2	return value from my_func1	return value from my_func2	j
0	False	n/a	0	0
1	True	1	n/a	1
2	False	n/a	4	5
3	True	9	n/a	14
4	False	n/a	8	22
5	True	25	n/a	47

**29. Correct Answer: C.**

See above code trace. `my_func1` will be called when `i` is odd.

**30. Correct Answer: D.**

See above code trace. The value of `j` will be 47.