



UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)

Academic Year 2018 – 2nd Year Examination – Semester 4

IT4105 – Programming II
Part 1 - Multiple Choice Question Paper
29th September, 2018
(ONE HOUR)

Important Instructions :

- The duration of the paper is **1 (one) hour**.
- The medium of instruction and questions is English.
- The paper has **25 questions** and **11 pages**.
- All questions are of the MCQ (Multiple Choice Questions) type.
- All questions should be answered.
- Each question will have 5 (five) choices with **one or more** correct answers.
- All questions will carry equal marks.
- There will be a penalty for incorrect responses to discourage guessing.
- The mark given for a question will vary from 0 (*All the incorrect choices are marked & no correct choices are marked*) to +1 (*All the correct choices are marked & no incorrect choices are marked*).
- Answers should be marked on the special answer sheet provided.
- Note that questions appear on both sides of the paper.
If a page is not printed, please inform the supervisor immediately.
- Mark the correct choices on the question paper first and then transfer them to the given answer sheet which will be machine marked. **Please completely read and follow the instructions given on the other side of the answer sheet before you shade your correct choices.**

- 1) Assume that a stack is being used to check for *Matching Parentheses* of the statement below. What is the **maximum** number of tokens that will appear on the stack during the evaluation of this expression?

$1+1-1*(1+1[1+1])+1-\{[(1+1)/1]*1\}+1$

- | | | |
|--------|--------|-------|
| (a) 2 | (b) 3 | (c) 4 |
| (d) 5] | (e) 6] | |

- 2) Dry run (hand execute) the following pseudocode segment.

```
q = queue();
for(i = 1; i < 15; i++)
    if(i % 3 != 0){
        q.enqueue(i)
    }else{
        q.dequeue()
    }
}
```

Which of the following answers correctly show(s) the content of the queue?

- | |
|--------------------------------------|
| (a) 1,2,3,4,5,6,7,8,9,10,11,12,13,14 |
| (b) 7,8,10,11,13,14,15 |
| (c) 7,8,10,11,13,14 |
| (d) 7,8,11,13,14 |
| (e) 1,4,7,10,13 |

- 3) Before calling the *enqueue()* method in an array based stack, which of the following condition(s) must be checked?

- | | | |
|----------------------|--------------------------------|--------------|
| (a) Existing element | (b) Maximum element | (c) overflow |
| (d) underflow | (e) previously entered element | |

- 4) Suppose you have an array implementation of the circular queue class, with data [8] to data [9] filled. All other locations of the array are empty. The Array length is 10. Where does the *enqueue* method place the new entry in the array?

- | | | |
|-------------|-------------|-------------|
| (a) data[9] | (b) data[7] | (c) data[0] |
| (d) data[5] | (e) data[1] | |

5) The structure of a list node implementation is as follow,

```
Class node{
    int value = 0;
    Node next = null;
}
```

Assume that a linked list with elements 1, 2, 3, 4 and 5 is created using the above node. The start of the list is assigned to the pointer variable L.

You are asked to add the value 6 to the list, between the 3rd and 4th elements.

- i. L.next.next.next = tmp;
- ii. Node tmp = L.next.next;
- iii. L.next.next = new node();
- iv. L.next.next.value = 6;

Which of the following answers show(s) the correct order of steps (i - iv) to achieve the above mentioned operation?

- (a) i→ii→iii→iv
(b) ii→iii→iv→i
(c) iv→i→iii→ii
(d) iii→ii→i→iv
(e) iii→i→ii→iv

6) Dry run (hand execute) the following pseudocode segment

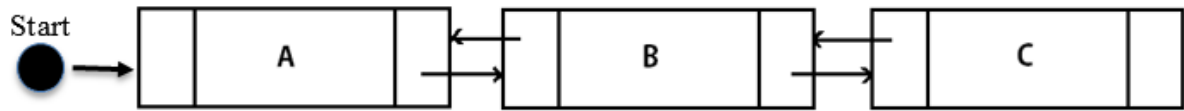
values = Stack ()

```
for (int i=1;i<10;i++){
    for (int j=2;j<5;j++){
        if (i % j == 0 )
            values.pop()
        else
            values.push( i )
    }
}
```

Which of the following answers show(s) the correct content of the queue?

- (a) 1,2,3,4,5,6,7,8
(b) 1,2,5,6,7,9
(c) 1,1,2,2,5,6,7,7,9
(d) 2,3,4,4,6,6,8,8,9
(e) 2,3,4,4,5,6,6,8,8,9,10,10

- 7) Which of the following answers show(s) the correct steps to remove the **Node B** from the doubly linked list below?



- (a) (i) `Start.next=start.next.next` (ii) `Start.next.next.prev=Start.next.prev`
 (b) (i) `Start.next.next.prev=Start.next.prev` (ii) `Start.next=start.next.next`
 (c) (i) `Start.next.next=Start.next.prev` (ii) `Start.next=start.next.next`
 (d) (i) `Start.next.next.prev=Start.next.prev` (ii) `Start.next=start.next`
 (e) (i) `Start.next.next.prev=Start.prev.prev` (ii) `Start.next=start.next.next`

- 8) Consider the following Program.

```

1.  public static int fibonacci(int n)
2.  {
3.    if (n == 0)
4.      return 0;
5.    else if (n == 1)
6.      return 1;
7.    else return fibonacci(n-1) + fibonacci(n-2);
8.  }
```

How many recursive calls does the above method contain, and what line number has the recursive call respectively.

- | | | |
|-------------|-------------|-------------|
| (a) 3 and 7 | (b) 2 and 7 | (c) 4 and 7 |
| (d) 3 and 6 | (e) 2 and 6 | |

9) Consider the following Java Code Segment.

```
class abc
{
    public static int pqr(int n)
    {
        if (n <= 1)
            return n;
        return n + pqr(n - 1);
    }

    // Driver code
    public static void main(String args[])
    {
        int n = 5;
        System.out.println(pqr(n));
    }
}
```

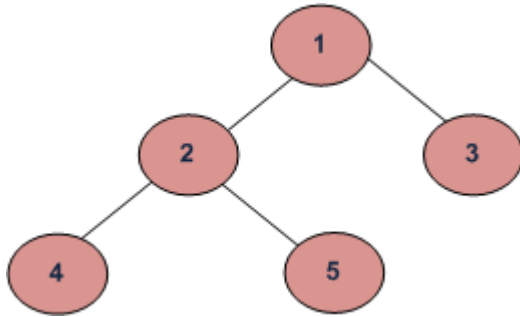
- (i) What is the above java code segment intended to do?
(ii) What is the outcome of the above java code segment?

- (a) (i) Recursive procedure used to calculate the factorial value of 5 (ii) 120
(b) (i) Recursive procedure used to calculate the greatest common divisor of 5 (ii) 25
(c) (i) Recursive procedure used to calculate the summation of first five numbers
(ii) 15
(d) (i) Recursive procedure used to calculate the height of a binary search tree (ii) 5
(e) (i) Recursive procedure used to calculate the size of a binary search tree (ii) 15

10) In a full binary tree if number of internal nodes is L, then the total number of nodes N is?

- | | | |
|---------------|---------------|---------------|
| (a) $N=2L-1$ | (b) $N=L^2-1$ | (c) $N=2^L-1$ |
| (d) $N=L^2+1$ | (e) $N=2L+1$ | |

11) Consider the following Binary Tree.



What is the order of nodes of the tree if traversed in the following sequence?

Pre-order

In-order

Post-order

Breadth First Order

- (a) (1 2 4 5 3), (4 2 5 1 3), (4 5 2 3 1), (1 2 3 4 5)
- (b) (1 2 4 5 3), (4 2 5 3,1), (4 5 2 3 1), (1 2 3 4 5)
- (c) (1 2 4 5 3), (4 2 5 1 3), (1 2 3 4 5), (4 5 2 3 1)
- (d) (1 2 4 5 3), (4 5 2 3 1), (1 2 3 4 5), (4 2 5 1 3)
- (e) (1 2 4 5 3), (4 2 5 3,1), (4 3 5 2 1), (1 2 3 4 5)

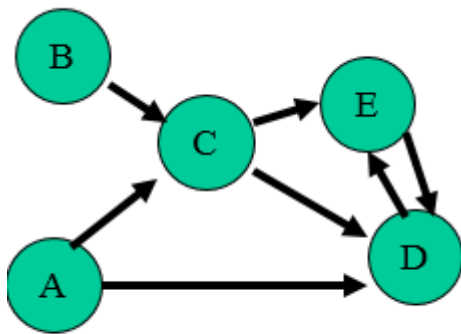
12) Which of the following statements is/are correct in respect to an AVL tree?

- (a) It is a binary search tree
- (b) In any node in the tree, height of the Left sub-tree and height of the right subtree differs by at most 2
- (c) All the imbalance situations can be eliminated by using the clockwise single rotations
- (d) Worst case time complexity is $O(\log n)$
- (e) It is used for indexing large records in database to improve search.

13) Which of the following statements is/are valid in connection with graph data structures?

- (a) Graphs are used to represent networks
- (b) Graphs are used for indexing IP addresses
- (c) Graphs are used in social networks such as LinkedIn and Facebook
- (d) Graph fully describe their adjacency matrix in array based implementation.
- (e) Graphs are used to evaluate expression trees

Questions 14 and 15 are based on the following directed graph.



- 14) The Adjacency matrix of the above directed graph is:

(a)

	A	B	C	D	E
A	F	F	T	T	F
B	F	F	T	F	F
C	F	F	F	T	T
D	F	F	F	F	T
E	F	F	T	T	F

(b)

	A	B	C	D	E
A	F	F	T	T	F
B	F	F	T	F	F
C	F	F	F	T	T
D	F	F	F	F	T
E	F	F	F	T	F

(c)

	A	B	C	D	E
A	F	F	T	T	T
B	F	F	T	F	F
C	F	F	F	T	T
D	F	F	F	F	T
E	F	F	F	T	F

(d)

	A	B	C	D	E
A	F	T	T	T	F
B	F	F	T	F	F
C	F	F	F	T	T
D	F	F	F	F	T
E	F	F	F	T	F

(e)

	A	B	C	D	E
A	F	F	T	T	F
B	F	F	T	F	F
C	F	F	F	T	T
D	F	F	F	F	T
E	F	F	F	T	T

15) The Path Matrix (transitive closure) of the above directed graph is:

(a)

	A	B	C	D	E
A	F	F	T	T	T
B	F	F	T	T	T
C	F	F	F	T	T
D	F	F	F	F	T
E	F	F	F	T	F

(b)

	A	B	C	D	E
A	F	F	T	T	T
B	F	F	T	T	T
C	F	F	F	T	T
D	F	F	F	F	T
E	F	F	F	T	T

(c)

	A	B	C	D	E
A	F	F	T	T	T
B	F	F	T	T	T
C	F	F	F	T	T
D	F	F	F	F	T
E	F	F	F	T	F

(d)

	A	B	C	D	E
A	F	F	T	T	F
B	F	F	T	F	F
C	F	F	F	T	T
D	F	F	F	F	T
E	F	F	F	T	F

(e)

	A	B	C	D	E
A	F	F	T	T	T
B	F	F	T	T	T
C	F	F	F	T	T
D	F	F	F	T	T
E	F	F	F	T	T

16) What is true about the in-order traversal of a binary search tree?

- (a) It traverses in a decreasing order
- (b) It traverses in an increasing order
- (c) It traverses in a random fashion
- (d) It traverses in level order traversal
- (e) It traverses in the following fashion:
 - (i) Traverse a right subtree with a recursive call ,
 - (ii) visit the root
 - (iii) traverse a left subtree with a recursive call

17) Consider the following diagrams.

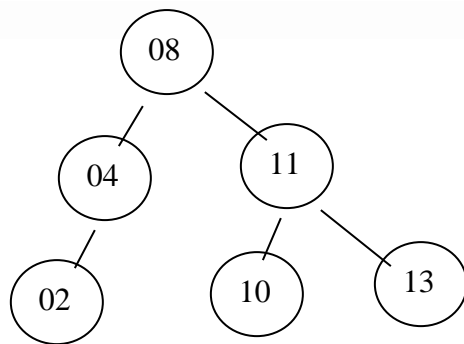


Diagram A

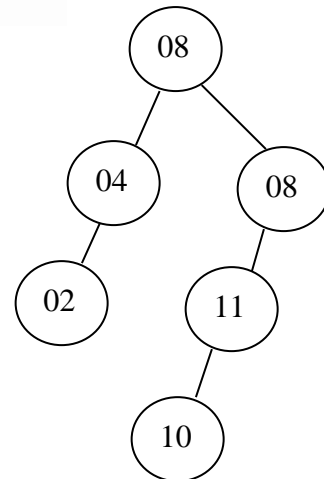


Diagram B

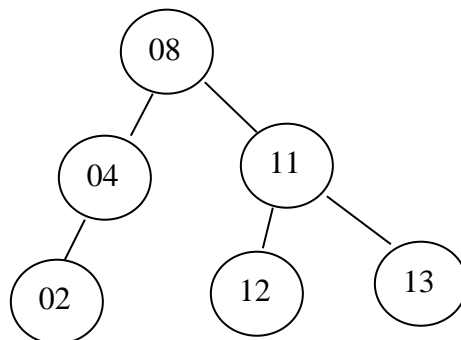


Diagram C

Which of above diagrams is/are follow(s) AVL properties?

- (a) Diagram A and Diagram C only
- (b) Diagram B only
- (c) Diagram A only
- (d) Diagram A and Diagram B only
- (e) None of the Above

18) What is the time complexity to insert a node based on key in a priority queue?

- | | | |
|-------------------|-----------------|------------|
| (a) $O(n \log n)$ | (b) $O(\log n)$ | (c) $O(n)$ |
| (d) $O(n^2)$ | (e) $O(n^3)$ | |

19) Linked lists are not suitable for the implementation of which of the following:

(a) Insertion sort	(b) radix sort	(c) Heap sort
(d) polynomial manipulation	(e) binary search tree	

20) The essential condition which is checked before insertion to a linked queue is:

(a) underflow	(b) overflow	(c) front value
(d) rear Value	(e) None of the above	

21) What is the time complexity of the method given below:

```
int fun(int n)
{
    int count = 0;
    for (int i = n; i > 0; i /= 2)
        for (int j = 0; j < i; j++)
            count += 1;
    return count;
}
```

(a) $O(1)$	(b) $O(n)$	(c) $O(\log n)$
(d) $O(n \log n)$	(e) $O(n^2)$	

22) Sort the following array using selection sort. How many iterations will be done to sort the array?

[43,2,52,6,63,21,12]

(a) 5 only	(b) 4 only	(c) 7 only
(d) 3 only	(e) 6 only	

23) You are required to sort 10 GB of data with only 1 GB of available main memory. Which sorting technique will be most appropriate?

(a) Quick Sort	(b) Merge Sort	(c) Heap Sort
(d) Selection sort	(e) Insertion sort	

- 24) Suppose we need to sort an array of six elements in descending order using heap sort. We have completed some heapify operations. The array now looks like this:

[15, 17, 16, 19, 10, 7]

How many heapify operations have been performed on the root of the heap?

(a) 1	(b) 2	(c) 3
(d) 3,4	(e) 5	

- 25) Consider the following array with 15 elements. Identify all the elements that will be found by examining 3 or fewer number of array elements if the binary search algorithm is used.

[12, 2, 14, 7, 6, 13, 10, 8, 9, 3, 1, 15, 5, 11, 4]

Note: Set $\text{top} = \text{arraysize} - 1$; set $\text{bottom} = 0$. When calculating the middle, set middle to the floor of $(\text{top} + \text{bottom})/2$.

(a) 8,7,2,13	(b) 8,4,2,6	(c) 2,4,8,12,14
(d) 2,7,13,8,3,15,11	(e) 2,4,6,8,10,12,14	
