

ANSWER ALL QUESTIONS – WORKING SHOULD BE SHOWN

1) Question on recursion.

a) What do we mean by recursion? [1]

b) For the following function find the base case and the general case: [2]

$$\text{sum}(n) = 1 + 2 + 3 + \dots + n$$

c) Fill in the missing parts (i.e. where there is a **\***) of the following recursive function that implements sum(n) above. [2]

```
int sum (int n)
{
    if (n == 1)
        return *;
    else
        return * * ;
}
```

2) This question is about data structures.

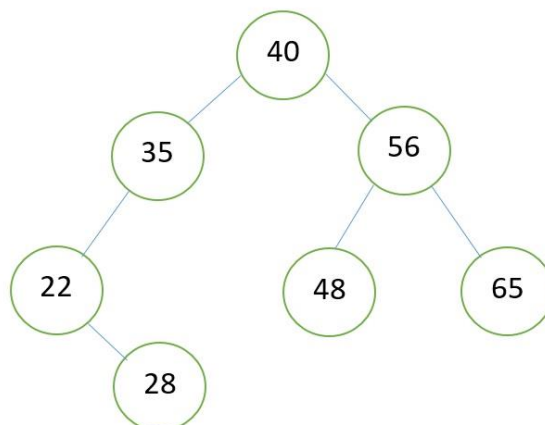
a) Explain the following data structures:

- i). Array [2]
- ii). Record [2]
- iii). Queue [2]

b) A stack ST contains numbers. By using the basic operations push, pop and isEmpty, how can you find the maximum number inside ST. (Hint: you can use another stack to help you solve the problem). [5]

c) A linked list is implemented by means of two arrays and two references as shown in the following diagram.

d) For the following binary search tree perform the three traversals i.e. pre-order, in-order and post-order. [3]



e)

Places		References	
0		0	1
1		1	-1
2		2	4
3	Zurrieq	3	9
4		4	8
5	Gzira	5	6
6	Tarxien	6	-1
7	Floriana	7	3
8		8	0
9	Mellieha	9	5

StartList = 7  
StartEmptyList = 2

- i). Write the places in the sequence they are stored in the list. [1]
  - ii). Perform the following operations and then show how the arrays and references change. [3]
    - 1) Add Nadur as the first element.
    - 2) Add Rabat as the last element.
    - 3) Delete Tarxien.
- 3) Give a description of the following terms:
- a) SRAM [2]
  - b) DRAM [2]
  - c) Cache [2]
  - d) NIC [1]
- 4) Explain the following types of operating systems:
- a) Multiprogramming [1]
  - b) Multiprocessing [1]
  - c) Multitasking [1]
  - d) Multithreading [1]