

2. (This complete question is worth 30 marks)

- (i) State the defining characteristics of a *Priority Queue*, and state the standard operations offered in the Priority Queue ADT. For each operation, give a brief comment explaining what it does.

(6 marks)

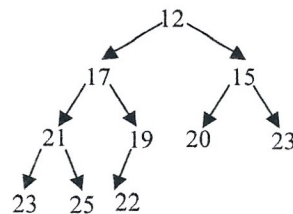
- (ii) Describe how to implement a Priority Queue using an *unsorted* Doubly-linked list, and state the worst-case complexities of the operations.

(5 marks)

- (iii) State the defining characteristics of a (*min*) *Binary Heap*, give a clear description (using text, diagrams or pseudocode) of the operations to add and remove elements, and explain how it can be used to implement a Priority Queue. State the complexity of the add and remove operations for a heap with  $n$  elements.

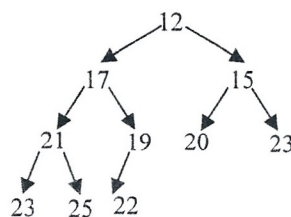
(8 marks)

- (iv) For the min binary heap below, show the resulting binary heap when you add element 14.



(3 marks)

- (v) For the min binary heap below, show the resulting binary heap when you remove element 12.



(3 marks)

- (vi) Explain how a min binary heap can be represented using a Python list, and explain in detail how the add and remove methods can be implemented efficiently. Use the example heap shown in (v) above as an example to support your explanation.

(5 marks)