

Question 1 [30 marks]

- a) Explain the difference between Cluster computing and Grid computing (6 marks)
- b) Describe what cloud computing is (3 marks)
- c) What are the various features of clusters? (4 marks)
- d) Describe some of the services that are offered by different vendors for cloud computing (6 marks)
- e) Explain the difference between high-performance computing (HPC) and High-throughput computing (HTC) (5 marks)
- f) There's always a tradeoff between usability and security. What is the main problems of connecting all the nodes directly to the external network in a cluster? (4 marks)
- g) What are some of the features of cluster computing? (4 marks)

Question 2 [20 marks]

- a) A deployment model in cloud computing defines the purpose of the cloud and the nature of how the cloud is located. Discuss some of the deployment models available (8 marks)
- b) Discuss the technical benefits of cloud computing (12 marks)

Question 3 [20 marks]

- a) Cluster computing can be classified into many categories, discuss the various categories of classification (12 marks)
- b) What do you understand by the term RMS (Resource Management and Scheduling)? Discuss the components of the software that performs RMS (8 marks)

Question 4 [20 marks]

- a) Discuss the essential characteristics that cloud computing systems must offer (10 marks)
- b) In High-Throughput Computing, there is middleware which is a software layer that enables the coordinated use of multiple resources which are drawn from a datacenter or geographically distributed networked computers. Discuss

the common operations that the middleware needs to support the creation and execution of task-based applications. **(10 marks)**

Question 5 [20 marks].

- a) There are several frameworks that can be used to support the execution of task-based applications on distributed computing resources, including clouds. Discuss some of the popular software systems that support the task-computing. **(10 marks)**
- b) Discuss the main components of a high-level architecture for supporting energy efficient resource allocation in a green cloud computing infrastructure **(10 marks)**