

Two hours

Question ONE is COMPULSORY

**UNIVERSITY OF MANCHESTER  
SCHOOL OF COMPUTER SCIENCE**

Component-based Software Development

Date: Friday 27th May 2016

Time: 09:45 - 11:45

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**Please answer Question ONE in Section A and any TWO other Questions in Section B**

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This is a CLOSED book examination

The use of electronic calculators is NOT permitted

**[PTO]**

**Section A**

1. a) What is a component? Illustrate your answer with suitable examples. (4 marks)
  
- b) What does a component model define? Illustrate your answer with a suitable example. (4 marks)
  
- c) What are the merits and demerits of objects as components? Illustrate your answer using the results of your lab exercise. (4 marks)
  
- d) Briefly describe the idealised component life cycle. (4 marks)
  
- e) What are the merits and demerits of encapsulated components? Illustrate your answer using the results of your lab exercise. (4 marks)

**Section B**

2. a) Explain the X-MAN component model in terms of:
- i) components; (2 marks)
  - ii) composition connectors; (2 marks)
  - iii) data passing; (2 marks)
  - iv) development life cycle. (2 marks)
- b) How is an encapsulated component different from architectural units? Illustrate your answer with suitable examples. (4 marks)
- c) Consider a coin-operated vending machine that makes and sells cups of tea and coffee, with or without milk. To buy a drink, the customer inserts one coin and selects the drink (all drinks are the same price). No change is given. Moreover, the machine serves only regular size drinks, and its stock is infinite. Once the inserted coin has been validated, the machine dispenses the selected drink.
- Use the X-MAN component model to build a system for this machine. You need to:
- i) Identify the required components. For each component, list its provided services. (2 marks)
  - ii) Use suitable connectors to implement the system. (2 marks)
  - iii) Identify the services provided by the system. (2 marks)
  - iv) Specify all the data channels in the system. (2 marks)

3. a) Explain the EJB (Enterprise JavaBeans) component model in terms of:
- i) components; (2 marks)
  - ii) composition mechanisms; (2 marks)
  - iii) development life cycle. (2 marks)
- b) Compare EJB and JavaBean component models in terms of:
- i) component definitions; (2 marks)
  - ii) composition mechanisms; (2 marks)
  - iii) development life cycles. (2 marks)
- c) Consider the vending machine in Question 2. Use EJB to build a system for this machine. You need to:
- i) Identify the required beans. For each bean, list its interfaces. (2 marks)
  - ii) Design the system using the identified beans. (2 marks)
  - iii) Use a suitable notation to express the control flow in your system. (2 marks)
  - iv) Identify any client applications and interfaces involved. (2 marks)

4. a) Explain the UML 2.0 component model in terms of:
- i) components; (2 marks)
  - ii) composition mechanisms; (2 marks)
  - iii) development life cycle. (2 marks)
- b) Compare and contrast UML 2.0 with any other ADL in terms of:
- i) component definitions; (2 marks)
  - ii) composition mechanisms; (2 marks)
  - iii) development life cycles. (2 marks)
- c) Consider the vending machine in Question 2. Use UML 2.0 to build a system for this machine. You need to:
- i) Identify suitable components, along with their provided and required services. (2 marks)
  - ii) Design the system using the identified components. (2 marks)
  - iii) Describe the system behaviour. You can use a suitable UML diagram (e.g. sequence diagram) to express this. (2 marks)
  - iv) Identify required and provided system services. (2 marks)