17/1/2019

09.30 - 11.30am

Basement 1, Kevin Street

DUBLIN INSTITUTE OF TECHNOLOGY

DT228 BSc. (Honours) Degree in Computer Science

DT282 BSc. (Honours) Degree in Computer Science (International)

Year 2

WINTER EXAMINATIONS 2018/2019

SOFTWARE ENGINEERING 1 [CMPU2019]

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THURSDAY 17TH JANUARY 9.30 A.M. – 11.30 A.M.

2 HOURS

INSTRUCTIONS TO CANDIDATES
ANSWER **FOUR** QUESTIONS OUT OF **FIVE**.
ALL QUESTIONS CARRY EQUAL MARKS.

1. **(a)** Software is required to keep a record of the passengers who have boarded an aircraft. An aircraft has a maximum capacity.

   Provide an UML class diagram which specifies the state of the software system and which also shows two operations which modify the state.

   Describe briefly a class invariant which applies here but which a class diagram cannot show. Also using natural language or set notation, specify one of the operations more precisely by providing an appropriate contract for it.

   (7 marks)

   (b) Give a *UML-based Specification Environment* (USE) specification for the class diagram from part (a) along with an OCL contract for one operation. Do not consider the implementation of the operation at this stage, just describe what is does rather than how.

   (10 marks)

   (c) Using SOIL,
   - provide an abstract implementation of the operation described in part (b),
   - create some test objects which will allow you to test your specification in USE.

   Explain how you could then test your model using the USE command line interface.

   (8 marks)

2. **(a)** Provide a use case description for the following 3 library usecases:
   - return book
   - borrow book
   - borrow book and pay fine

   and draw a corresponding usecase diagram.
   When is it appropriate to split a usecase using extends?

   (10 marks)

   (b) Outline two advantages and two disadvantages in using usecases for describing requirements.

   (5 marks)

   (c) What is meant by usecase realisation? Illustrate it with respect to the *borrow book* usecase.

   (10 marks)

3. **(a)** What is meant by requirement engineering? Describe some of the problems or issues in this activity when it is part of the Waterfall lifecycle.

(10 marks)

(b) Describe the four phases of the Unified Process (UP) paying particular attention to the Elaboration and Construction phases.

(15 marks)

4. **(a)** Explain what is meant by the terms *modularity* and why it is important in programming and software design.

What is meant by encapsulation in object oriented design and how does it relate to coupling and cohesion? How well is it supported in an object oriented language you are familiar with?

(10 marks)

(b) How are coupling and cohesion affected by inheritance when using object-oriented programming principles?

(7 marks)

(c) Explain what an interface is and provide two ways of showing one in UML. Then comment on the meaning of the following UML diagram. How does this design affect coupling and cohesion?

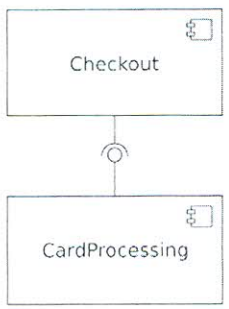

Figure Q4(c)

(8 marks)

5. **(a)** Explain what design patterns are and comment on how they may help software design.

(8 marks)

(b) Draw an example object diagram which illustrates what is meant by a part-whole hierarchy.

With the aid of a class diagram and comments, describe an appropriate design for interacting with part-whole hierarchies in a uniform way. List two advantages of this design.

(12 marks)

(c) How can a one-to-many class association be implemented in Java or Python? Please use a short code fragment to illustrate your answer.

(5 marks)