Universiti Malaysia PAHANG

Engineering • Technology • Creativity

FACULTY OF COMPUTER SYSTEMS & SOFTWARE ENGINEERING

FINAL EXAMINATION

COURSE	:	**FORMAL METHODS**
COURSE CODE	:	**BCS2213**
LECTURER	:	**VITALIY MEZHUYEV**
DATE	:	**18 JUNE 2015**
DURATION	:	**3 HOURS**
SESSION/SEMESTER	:	**SESSION 2014/2015 SEMESTER II**
PROGRAMME CODE	:	**BCS / BCN / BCG**

INSTRUCTIONS TO CANDIDATE:

1. This question paper consists of **THREE (3)** questions. Answer **ALL** questions.
2. Write your answers in the answer booklet provided.
3. Answer EACH question on a new page.
4. All calculations and assumptions must be clearly shown.

EXAMINATION REQUIREMENTS:

NONE

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

This examination paper consists of **THREE (3)** printed pages including the front page.

QUESTION 1 [37 Marks]

Develop Z notation specification for a computer system, intended to process theatre tickets. Tickets can have two types: the standard and the first night (premier) ones. The first night tickets are available only for friends. Develop the purchase tickets operation, the schema that reports a successful ticket sale and the schema for "ticket not available" situation. Comment your statements.

Your specification should contain:

Definition of the basic types	[2 Marks]
Definition of the type of the tickets	[2 Marks]
Definition of the standard schema	[6 Marks]
Definition of the friend's schema	[6 Marks]
Definition of purchase schema	[8 Marks]
Definition of the "ticket not available" schema	[4 Marks]
Definition of the success/fail type	[2 Marks]
Definition of the schema that reports successful ticket sale	[3 Marks]
Possible combinations of schemas	[4 Marks]

QUESTION 2 [30 Marks]

In the movie Die Hard 3, the heroes must obtain exactly 4 gallons of water using a 5 gallon jug, a 3 gallon jug, and a water faucet. Develop TLA specification of this problem which will allow to solve it with TLC.

Remember that our heroes must measure out 4 gallons of water. Obviously, those 4 gallons must be in the 5 gallon jug. So, they have solved their problem when they reach a state where the amount of water in the big gallon jug is 4 gallons. Define the predicate asserting it.

Comment your statements.

Your specification should contain:

Definition of the variables	[2 Marks]
Definition of the type invariant	[3 Marks]
Definition of the initial predicate	[3 Marks]
Definition of the actions that heroes can perform	[12 Marks]
Definition of the next-state relation	[4 Marks]
Definition of the final specification	[3 Marks]
Definition of the predicate asserting successful solution	[3 Marks

QUESTION 3 [33 Marks]

Modelling real-time behaviour of a person (a writer), a coffee machine and an external observer in UPPAAL.

The problem is to model the behaviour of a system with three components, a coffee Machine, a Person and an Observer. The person repeatedly tries to insert a coin, next tries to extract coffee after which (s)he will make a publication. Between each action, the person has a suitable time-delay before being ready to participate in the next one. After receiving a coin, the machine should take some time for brewing the coffee. The machine should take time-out if the brewed coffee has not been taken before a certain upper time limit. The observer should complain if at any time more than 8 time-units elapses between two consecutive publications.

Write short textual description (2-3 sentences) for every component of the modelled system.

Your specification should contain:
UPAALL automata, describing:

Machine [9 Marks]

Observer [9 Marks]

Person [9 Marks]

Comments, describing:

Machine [2 Marks]

Observer [2 Marks]

Person [2 Marks]

END OF QUESTIONS PAPER