



**Universiti  
Malaysia  
PAHANG**

Engineering • Technology • Creativity

**FACULTY OF COMPUTER SYSTEMS & SOFTWARE ENGINEERING  
FINAL EXAMINATION**

<b>COURSE</b>	<b>:</b>	<b>FORMAL METHODS</b>
<b>COURSE CODE</b>	<b>:</b>	<b>BCS 2213</b>
<b>LECTURER</b>	<b>:</b>	<b>ROSLINA BINTI MOHD SIDEK</b>
<b>DATE</b>	<b>:</b>	<b>5 MAY 2008</b>
<b>DURATION</b>	<b>:</b>	<b>2 HOURS AND 30 MINUTES</b>
<b>SESSION/SEMESTER</b>	<b>:</b>	<b>SESSION 2007/2008 SEMESTER II</b>
<b>PROGRAM CODE</b>	<b>:</b>	<b>BCS</b>

**INSTRUCTIONS TO CANDIDATES**

1. This question paper consists of **SIX(6)** questions. Answer **ALL** .
2. All answers to a new question should start on new page.
3. Candidates are not allowed to bring any material other than those allowed by the invigilator into the examination room.

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

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This examination paper consists of **SIX (6)** printed pages including front page.

**QUESTION 1 (4 MARKS)**

(a) Let  $A = \{n \in \mathbb{N} \mid n \leq 10\}$  and  $B = \{n \in \mathbb{N} \mid n > 9\}$

(i) Write down all the elements of  $A \cap B$ .

[1 Mark]

(ii) Write down all the elements of  $A \setminus B$ .

[1 Mark]

(iii) Describe the set  $A \cup B$ .

[1 Mark]

(iv) Solve this problem:  $|A \setminus B|$

[1 Mark]

**QUESTION 2 (4 MARKS)**

(a) In this question, use the following key:

$P(x)$	'x is a professor'
$K(x,y)$	'x knows y'
a	'Anne'
b	'Bob'

(i) Translate the formula  $P(a) \wedge \forall x(P(x) \rightarrow K(b,x))$  into English.

[2 Marks]

- (ii) Write down an English sentence which follows from the sentence you wrote down in (i). **[1 mark]**

- (iii) Express your new sentence in Predicate Calculus notation to show the conclusion of the statement in (ii). **[1 Mark]**

### QUESTION 3 (5 MARKS)

- (a) Explain what is meant by the power set  $P(S)$  of a set  $S$ . Illustrate your answer by writing out the elements of  $P(\{a, b, c\})$ . **[2 Marks]**

- (b) The proper subset relation  $\subset$  is defined on  $P(S)$  as follows:

$$X \subset Y \leftrightarrow X \subseteq Y \wedge X \neq Y.$$

Draw a diagram to illustrate this relation on the set  $P(\{a, b, c\})$ . Your diagram should show an arrow from element  $X$  to element  $Y$  if and only if  $X \subset Y$ . **[3 Marks]**

**QUESTION 4 (7 MARKS)**

(a) Convert these informal statements to formal statement using the table below:

	Symbol	Interpretation
Constants	L	The lecturer
	S	The student
Predicates	$G(x)$	x is a girl
	$B(x)$	x is a boy
	$H(x)$	x is study hard
	$L(x)$	x is a lecturer
	$C(x, y)$	x is clever than y
	$R(x, y)$	x respects y

(i) Every student respect all lecturers

[1 Mark]

(ii) There is a girl which is study hard

[3 Marks]

(iii) The girl student is clever than boy student

[3 Marks]



**QUESTION 5 (20 MARKS)**

Consider the following inference:

*If Anne will not go then Bill will*

*If Clive will not go then neither will Bill*

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*Therefore, either Anne or Clive will go*

- (a) Explain the meanings of the terms '**inference**' and '**validity**' as they are used in Logic.

**[2 Marks]**

- (b) Devise a suitable key with which to translate the inference above into Propositional Calculus notation and write down the result of the translation.

**[6 Marks]**

- (c) Construct a truth table for the Propositional Calculus inference you wrote down in (b) and use the truth table to determine whether or not that inference is valid.

**[12 Marks]**

**QUESTION 6 (20 MARKS)**

“You have to develop a system for student PETAKOM club. We assume there is a maximum number of a member of the club. Take the basic type [STUDENT] to be the set of all students and the global variable description member : N. The club will have 3 activities: Jungle Tracking, PC Fair and Family day. Student who wants to join the activities should pay RM 50.00 per activity. If the student registered in the club should get discount 40%.”

(a) Give the initial state, and state schema for the PETAKOM club system.

[1 Mark]

(b) From the above problem draw the Venn diagram for the system.

[3 Marks]

(c) Define **FOUR(4)** operations and create the schema for:

(i) Adding operation

[4 Marks]

(ii) Query operation

[4 Marks]

(iii) Error operation

[4 Marks]

(d) Shows the Venn diagram for one of the adding operations in (c).

[4 Marks]

**END OF QUESTION PAPER**