Curtin University
Department of Computing
Second Quiz – Semester 2, 2016

Subject: **Foundations of Computer Science 2001**
Index No.: **COMP2001**

Name:

Student ID:

Practical Time:

Time Allowed: 50 MINUTES, proceeded by a 5-MINUTE READING PERIOD during which time only notes may be made. The supervisor will indicate when answering may commence.

Aids Allowed:

To be supplied by the candidate: Nil
To be supplied by the University: Nil

General Instructions:

This test consists of 3 questions worth of 25 marks. Attempt ALL the questions. You may answer the questions in any order.

When answering the questions, use the space allocated for each question. In the unlikely event that you run out of space, use the additional space at the end of the test paper and clearly label your answer.

This test is worth 25% of the total marks for this unit.

Question 1 (6 marks total)

(a) Use Mathematical Induction to prove the following assertion.
For every positive integer n with $n \geq 4$, it holds $2^n \leq n!$ **(4 marks)**

(b) Calculate the Power set **P(S)** for a set **S** in the following cases**.**

- **S={∅}**
- **S={a,∅}**

(2 marks)

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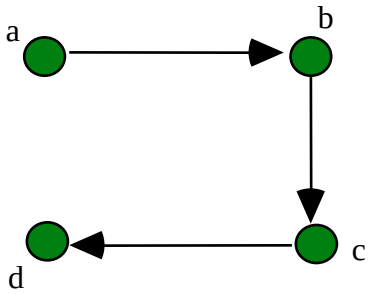
Question 2 (9 marks total)

(a) Let R be a relation defined on a set A={a,b,c,d} and it is given below.
(4 marks)



Iteratively compute $\mathbf{R^2}$ and $\mathbf{R^3}$

(b) Give the definition of poset and prove that $(Z^+, |)$ is poset.

(5 marks)

Question 3 (10 marks total)

1) Write out the following function in detail (for each variable, give its function value) and Determine whether the following function is one-to-one, onto or both.

F: $P(A) \times P(B) \rightarrow P(A \cup B)$
$F((X,Y)) = X \cup Y$**,**
where A={2,3}, B={5,6}

(4 marks)

2) Assuming you are a designer of a stationery maker factory. You want to add fruit-shaped plastic decoration (e.g *apple*) at the cap of writing stationery (e.g *pen*) to make them more attractive to clients. You now have a list of the objects you want to use as following. The decoration list is *D = {apple, pineapple, durian}*, while the stationery list is *S = {pen, pencil, marker}*. Then please answer the following question: **(3 marks)**

   a) How many different ways of putting the decoration D to one stationery in S if each stationery can have **up to** three stacked decorations (including one to three) and repetition **is allowed**?
   b) How many possible new products produced in total with this design idea?

c) (i) Find a recurrence relation for the number of bit sequences of length n with even number of 0s.
(ii) What are the initial conditions?
(iii) How many bit sequences of length 5 contain even number of 0s?

(3 marks)

End of Test