

Department of Computing
Quiz 2 – Semester 2, 2017

Subject: Foundations of Computer Science
Index No.: FCS1006

Name:

Student ID:

Time Allowed: 50 MINUTES, proceed by a 5 MINUTES READING

Aid 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 (7 marks total)

- (a) Use Mathematical Induction to prove that if $S_0=1$ and $S_n=2S_{n-1}+1$, then $S_n=2^{n+1}-1$ for every nonnegative integer n . **(3 marks)**

- (b) Given two sets $\mathbf{A} = \{\emptyset, \{a\}\}$, $\mathbf{B}=\{a, b, \{a\}, \{b\}\}$. Determine:

(4 marks)

a. $\mathbf{A} \cap \mathbf{B} =$

b. $\mathbf{A} \cup \mathbf{B} =$

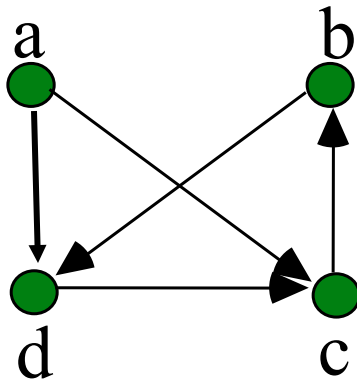
c. $\mathbf{P}(\mathbf{A}) =$

d. $\mathbf{B} \cap \mathbf{P}(\mathbf{A}) =$

Question 2 (8 marks total)

(a) Let \mathbf{R} , a relation defined on a set $\mathbf{A} = \{a, b, c, d\}$ given below.

(5 marks)



1) Answer the following questions and justify your answers.

- Is \mathbf{R} reflexive?
- Is \mathbf{R} antisymmetric?
- Is \mathbf{R} transitive?

2) Compute \mathbf{R}^2

(b) Let \mathbf{R} be equivalence relation on a set \mathbf{A} . Prove that \mathbf{RoR} is also an equivalence relation on \mathbf{A} .

(3 marks)

Question 3 (10 marks total)

(a) Let **E** and **F** be two events with $p(\mathbf{F}) > 0$. The conditional probability of **E** given **F** is defined as **(1 marks)**

(b) Assume that a family with three kids has uniform probability with any combination of boys and girls. Compute the following probability. **(3 marks)**

- The family has at least one girl.
- The family has one boy and two girls, given the condition that they have at least one girl.

- (c) In some countries, the car license plate consists of 3 alphabets letters (upper and lower case are the same) (letters not allowed for repetition) followed by 4 digits (digit can be repeated). How many different license plates can be produced?
(2 marks)

- (d) Recurrence Relation
- a. Find a recurrence relation for the number of bit strings of length n that **contain the pattern 01**. **(2 marks)**
 - b. What are the initial conditions? **(1 mark)**
 - c. How many such bit strings are there of length 4? **(1 marks)**