

SECI1013-06 STRUKTUR DISKRIT

TUTORIAL 3

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**QUESTION 1 [25 MARKS]**

1. Let , , and . Find each of the following:

[9 MARKS]

1. By referring to the properties of set operations, show that: [4 MARKS]

De Morgan’s laws

Double Complement laws

Associative laws

Idempotent laws

Distributive laws

Complement laws

Properties of universal set

1. Construct the truth table for, . [4 MARKS]

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| p | q |  |  |  | A |
| T | T | F | T | T | T |
| T | F | F | F | T | F |
| F | T | T | T | F | F |
| F | F | T | T | T | T |

1. Proof the following statement using direct proof

“For all integer , if is odd, then is odd” [4 MARKS]

Let:

is an odd integer

is an odd integer

with domain of discourse is the set of all integers

Let a is an odd integer. Then

for some integer n

where is an integer

is an odd integer where is an odd integer

Therefore, for all integers , if is odd, then is an odd.

1. Let be the propositional function . The domain of discourse for and is the set of all positive integers. Determine the truth value of the following statements. Give the value of and that make the statement TRUE or FALSE. [4 MARKS]

For example, if and , we obtain the true proposition as

But, if and , we obtain the false proposition as .

This statement is TRUE because is possible to find at least one positive integers for each and to make the proposition true.

This statement is FALSE because when and obtain the false proposition as

**QUESTION 2 [25 MARKS]**

1. Suppose that the matrix of relation on is

relative to the ordering 1, 2, 3. [7 MARKS]

* 1. Find the domain and the range of .
* Domain:
* Range:
  1. Determine whether the relation is irreflexive and/or antisymmetric. Justify your answer.



* The relation is not irreflexive because the main diagonal has 0 and 1
* The relation is antisymmetric because but , and and implies .

1. Let is a relation on Find: [6 MARKS]
   1. The elements of the set .
   2. Is reflexive, symmetric, transitive, and/or an equivalence relation? Justify your answer.

2

3

4

5

2 3 4 5

=



* S is not reflexive because the main diagonal is not ‘1’
* S is symmetric because and

* S is not transitive because
* Therefore, S is not an equivalence relation because S is not reflexive and transitive .

1. Let X={1, 2, 3}, Y={1, 2, 3, 4}, and Z={1, 2}. [6 MARKS]
   1. Define a function that is one-to-one but not onto.

1

2

3

4

1

2

3

* 1. Define a function that is onto but not one-to-one.

1

2

1

2

3

* 1. Define a function that is neither one-to-one nor onto.

1

2

3

1

2

3

1. Let and be functions from the positive integers to the positive integers defined by the equations:

[6 MARKS]

* 1. Find the inverse of .
  2. Find the compositions of .

**QUESTION 3 [15 MARKS]**

1. Given the recursively defined sequence.

, for all integers ,

1. Find the first three terms. [2 MARKS]
2. Write the recursive algorithm. [5 MARKS]

Input : integer positive

Output :

{

if

return 1

return

}

1. A certain computer algorithm executes twice as many operations when it is run with an input of size as it is run with an input of size (where is an integer that is greater than 1). When the algorithm is run with an input of size 1, it executes seven operations. Let the number of executes with an input size . Find a recurrence relation for . [4 MARKS]

When the input, k is 1 the output of operation will be 7 operation so  and the question said the algorithm will execute twice as many operations when its run so we have the sequence of:

Recurrence relation:

1. Given the recursive algorithm:

Input:

Output:

{

if

return 5

return

}

Trace S(4). [4 MARKS]

Because

return

Because

return

Because

return

Because

return 5

Return 5

Return 5\*5

Return 5\*25

Return 5\*125

**QUESTION 4 [25 MARKS]**

1. Hexadecimal numbers are made using the sixteen digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. They are denoted by the subscript 16. How many hexadecimal numbers begin with one of the digits 3 through B, end with one of the digits 5 through F and are 4 digits long?

[4 MARKS]

{3,4,5,6,7,8,9,A,B}

{5,6,7,8,9,A,B,C,D,E,F}

1. Suppose that in a certain state, all automobile license plates have four letters followed by three digits. How many license plates could begin with A and end in 0? [4 MARKS]

Letter = {A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z}

Digit = {0,1,2,3,4,5,6,7,8,9}

license plate ways

1. How many arrangements in a row of no more than three letters can be formed using the letters of word (with no repetitions allowed)? [5 MARKS]

one letters ways

two letters ways

three letters ways

ways

1. A computer programming team has 13 members. Suppose seven team members are women and six are men. How many groups of seven can be chosen that contain four women and three men? [4 MARKS]

ways

1. How many distinguishable ways can the letters of the word be arranged?

[4 MARKS]

Ways

1. A bakery produces six different kinds of pastry. How many different selections of ten pastries are there? [4 MARKS]

ways

**QUESTION 5 [10 MARKS]**

1. Eighteen persons have first names Ali, Bahar, and Carlie and last names Daud and Elyas. Show that at least three persons have the same first and last names. [4 MARKS]

Pigeons = Person

Pigeonholes = Name

By the generalized pigeonhole principle, at least 3 person must have the same first and last name.

1. How many integers from 1 through 20 must you pick in order to be sure of getting at least one that is odd? [3 MARKS]

Even integers =

Odd integers =

We could pick 10 integers that could all be even because there are 10 even integers. So to be sure of getting at least one odd integer, we need to pick integers.

1. How many integers from 1 through 100 must you pick in order to be sure of getting one that is divisible by 5? [3 MARKS]

Divisible by 5

20 integers that are divisible by 5 and 80 integers that are not divisble by 5.

We could pick 80 integers that are all not divisible by 5. In order to make sure of getting one that is divisible by 5, we must pick integers.