Department of Electrical and Computer Engineering
North South University

CSE 173: Discrete Mathematics; Section: 8
Semester: Spring 2022
Assignment 2 – Total point = 75
Deadline: **<u>21 April 2022</u>**

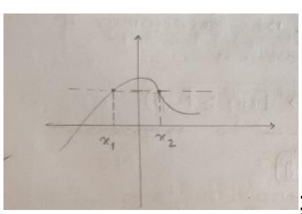
<u>Assignment Submission Guidelines:</u>

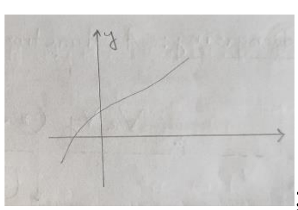
1. The assignment must be handwritten on A4 sized paper with proper scaling/margin maintaining proper page sequence/number and a cover page with your written name, ID and section.
2. The assignment paper and your handwriting must be neat and understandable.
3. Any evidence of plagiarism will lead to zero point.
4. Partial point will be awarded for partially correct answer provided no plagiarism is detected in the whole paper.
5. You need to submit the assignment to me during my **offline** office hours. Details about my office hours and office location can be found in the CANVAS *announcement* section.

Part 1 – Sets (25 marks)

1. Determine the cardinality of the following sets. (5 marks) -
   a. {2, 6, 7}; b. {5, 5, 6, 2, 2, 1, 1}; c. { }; d. {{1, 2}, {3, 4}}; e. {1, 2, 5, 6}
2. Show comparisons between *disjoint set* and *difference of set/set difference* (include Venn diagram). (5 marks)
3. Prove the De Morgan's Law $(A \cap B)' = A' \cup B'$ using set definition rules.
   N. B. Mention all the associated/used definitions and rules as side notes with every line required for proof. (10 marks)
4. Given $A = \{n\}$; $P(A) = ?$ (2 marks)
5. Given $A = \{1, 2\}$, verify if $A^3 = A^2 \times A$. (3 marks)

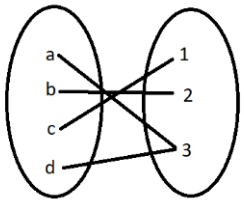
Part 2 – Functions (20 marks)

6. Define *one-to-one* function using predicates and quantifiers. (3 marks)
7. Determine which of the followings are *one-to-one* and/or *onto* functions – (5 marks)
   a. 

   ; b. 

   ; c. $f(n) = n^2$; d. $f(n) = n + 3$;
   e. $f(n) = \{n - 1$; *when n is odd*   *n is a natural number*
   $\{n + 1$; *when n is even*

8. Is the following function *onto*? If yes how, if no why? (2 marks)



9. Graphically represent the following functions – (10 marks)

   a. *one-to-one* but **NOT** *onto.*

   b. *onto* but **NOT** *one-to-one*.

   c. *one-to-one* **AND** *onto*.

   d. **NEITHER** *one-to-one* **NOR** *onto*.

   e. **NOT** a function.

Part C – Relations (27.5 marks)

10. Given $A = \{a, b\}$, $B = \{1, 2, 3\}$, find – (5 marks)

    a. number of relations from A to B.

    b. number of subsets of $A \times B$.

11. Verify if $R = \{(1, 1), (2, 2), (3, 3), (1, 2), (2, 1)\}$ is reflexive or symmetric or both? Explain with logical reasoning. (5 marks)

12. Prove that, "a divides b" is *transitive*. State all steps and assumptions. (10 marks)

13. Given $M_{R1} = \begin{matrix} 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{matrix}$ and $M_{R2} = \begin{matrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{matrix}$

    Now determine the followings – (7.5 marks)

    a. $M_{R1} \cup M_{R2}$

    b. $M_{R1} \cap M_{R2}$

    c. $M_{R1} - M_{R2}$

**(2.5 marks for neat and clean assignment paper with clear handwriting).