Discrete Mathematics
Final examination

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INSTRUCTIONS :

- The duration of this test is: 2 hours
- Answer **any five** of the six questions given below. All questions carry equal marks.
- Write legibly and clearly. Do not jump steps.
- Answer precisely, and to-the-point. Do NOT add irrelevant points and ideas. You will get penalty points (negative marks) for irrelevant and "beating around the bush" type of answers.

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1. Can a relation be neither reflexive nor irreflexive ? Justify your answer with an example.
2. Answer both sub-questions given below:
   (a) Does the Koenigsburg Bridges problem (KBP) have a solution ? Why ?
   (b) To solve the KBP, assume that you are allowed to build extra bridges, or destroy some existing bridges, or build some and destroy other bridges, in Koenigsburg.
   - Build only : What is the minimum number of bridges you will build ? Where ?
   - Destroy only : What is the minimum number of bridges you will destroy ? Which ones ?
   - Build and destroy : What is the minimum number of bridges you will build and destroy ? Which ones ?

   Justify your answer, using the graph-theoretic model of KBP.

3. Prove : In an undirected simple graph, the number of vertices of odd degree is even.

4. How many numbers can be formed using the digits : 1 , 3 , 4 , 5 , 6 , 7 , 8 (repetition of digits not allowed).

5. What is the coefficient of $x^3.y^7$ in $17(x+y)^{10}$? in $13(x-y)^9$?

6. Is the relation "*x is older than y*" a partial ordering ? Why ? What properties of binary relations does it satisfy ?

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