



INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR  
MA20013 - Discrete Mathematics  
Problem Sheet 1 Spring 2020

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Problem 1. Show that a graph  $G$  can not exist with vertices of degrees 2,3,4,4, and 5.

Problem 2. Let  $G$  be a graph of order  $n \geq 2$ , and suppose that for every vertex  $v$  of  $G$ ,  $\deg(v) \geq \frac{(n-1)}{2}$ . Prove that  $G$  is connected.

Problem 3. Prove that every  $u-v$  trail contains a  $u-v$  path, and every circuit contains a cycle.

Problem 4. Let  $G$  be a connected graph containing only even vertices. Prove that  $G$  cannot contain a bridge,

Problem 5. Give an example of a connected graph containing more bridges than the cut-vertices.

Problem 6. Give an example of a connected graph containing more cut-vertices than the bridges.

Problem 7. If  $G$  is a connected graph on  $n$  vertices other than the complete graph. If  $e$  is a bridge of  $G$ , then, show that  $e$  is incident with a cut-vertex in  $G$ .

Problem 8. Let  $G$  be graph of order  $n$  and size  $m$  so that  $m \geq n \geq 3$ . Show that  $G$  must contain a cycle.

Problem 9. Let  $G$  be a graph such that for every vertex  $v$  of  $G$ ,  $\deg(v) \geq 2$ . Show that  $G$  contains a cycle.

Problem 10. Let  $T$  be a tree on  $n(\geq 3)$  vertices. Show that  $T$  contains two vertices of degree 1.