CS 173, Spring 2015
Examlet 6, Part B

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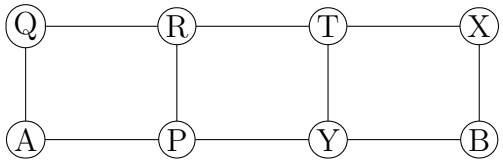
FIRST: | **LAST:**

Discussion: Monday 9 10 11 12 1 2 3 4 5



1. (8 points) How many cycle subgraphs (i.e. subgraphs isomorphic to C_n for some n) does the above graph contain? Count two cycles as the same if they have the same set of nodes; don't worry about (for example) which node is the start/end node. Briefly justify and/or show work.

   Solution: There is one cycle containing all 8 nodes. There are two cycles containing 6 nodes. And there are three cycles containing only 4 nodes. So there are a total of 6 cycles.

2. (3 points) What is the diameter of this graph?

   Solution: The diameter is 4. A sample pair of nodes separated by 4 edges are X and A.

3. (4 points) Is this graph bipartite? Briefly justify your answer.

   Solution: Yes it is. Put Q,P, T, B in one set and A, R, Y, X in the other set.

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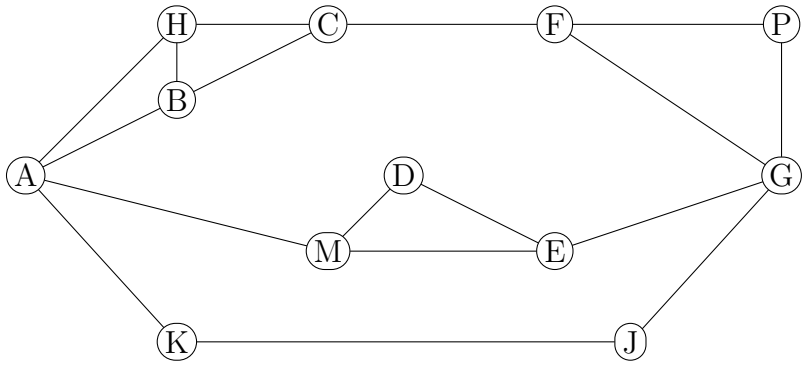

1. (8 points) Recall that a path never re-uses a node. How many paths are there from A to G in the above graph? Explain or show work.

   Solution: There are 8 paths across the top (4 ways to get from A to C, 2 ways to get from F to G). Then there are two paths via the middle route and one path along the bottom. So a total of $8 + 2 + 1 = 11$ paths.

2. (3 points) Is the above graph acyclic? Briefly explain why or why not.

   Solution: No it is not acyclic. For example, it contains the cycle A, B, H.

3. (4 points) Complete this statement of the Handshaking Theorem.

   For any graph G with set of nodes V and set of edges E, ...

   Solution: The sum of the node degrees is equal to twice the number of edges. (Or the equivalent in shorthand notation.)

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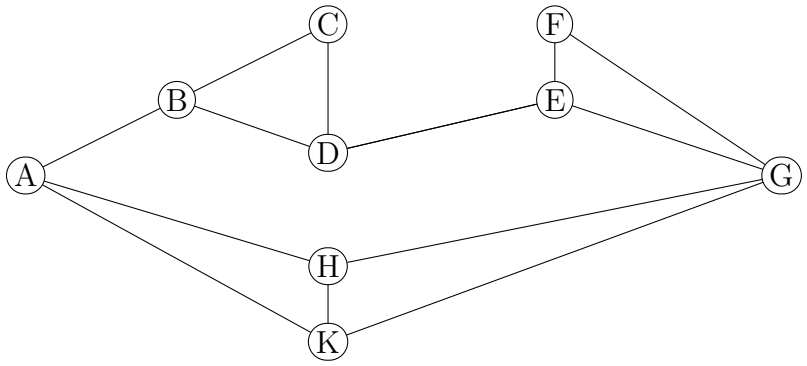

1. (8 points) Recall that a path never re-uses a node. How many paths are there from A to G in the above graph? Explain or show work.

   Solution: There are 4 paths along the upper route (two ways to get from B to D and two ways to get from E to G). There are four paths from A to G along the lower route. So a total of 8 paths.

2. (3 points) What is the diameter of the above graph?

   Solution: The diameter is 3. For example, A and E are three edges apart.

3. (4 points) What's the difference between an open walk and a closed walk?

   Solution: In a closed walk, the starting and ending nodes are the saem. In an open walk, they are different.

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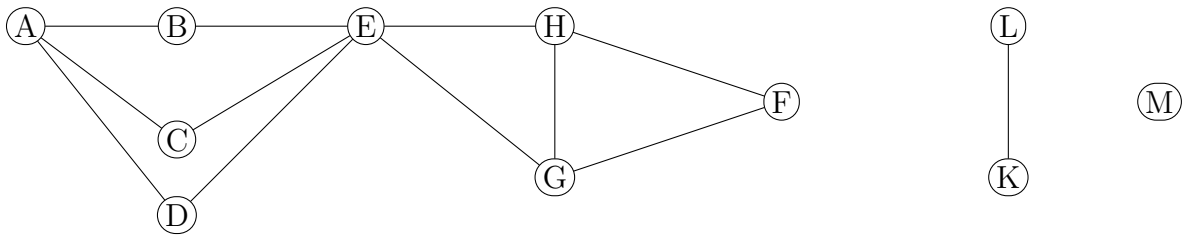

1. (3 points) Graph X (above) contains 11 nodes. How many connected components does X have?

   Solution: Three. One contains M. One contains L and K. The third contains the other nodes.

2. (8 points) Recall that a path never re-uses a node. How many paths are there from A to F in the above graph? Explain or show work.

   Solution: There are three ways to get from A to E. There are four ways to get from E to F. So there are $3 \cdot 4 = 12$ paths total.

3. (4 points) What is the difference between a cycle and a closed walk?

   Solution: A cycle uses each node only once, except that the first and last nodes are the same.

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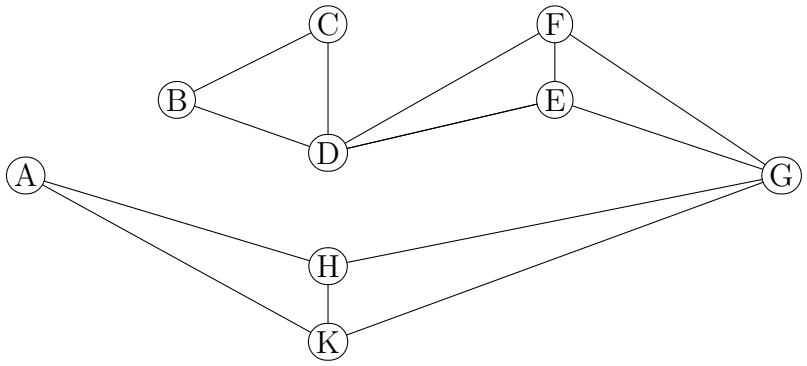

1. (8 points) Recall that a path never re-uses a node. How many paths are there from A to B in the above graph? Explain or show work.

   Solution: There are four ways to get from A to G. Then there are four ways to get from G to D. And two ways to get from D to B. So a total of $4 \cdot 4 \cdot 2 = 32$ paths.

2. (3 points) Does the above graph have a cut edge? Briefly explain why or why not.

   Solution: No, it does not. There is no edge that will break the graph into two pieces if you remove it, because every edge belongs to a cycle.

3. (4 points) Does this graph have an Euler circuit? Briefly justify your answer.

   Solution: No, it does not. There are nodes (e.g. H) that have odd degree.

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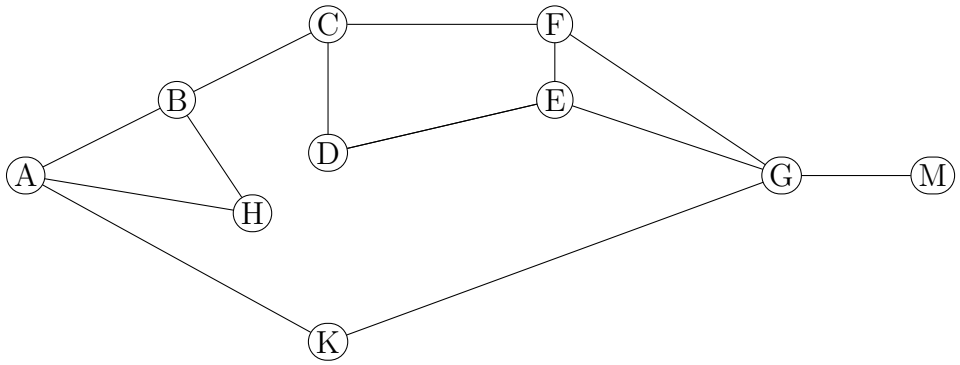

1. (8 points) Recall that a path never re-uses a node. How many paths are there from A to G in the above graph? Explain or show work.

   Solution: There is one path along the lower route (via K).

   Along the upper route, there are two ways to get from A to B, then four ways to get from C to G. So there are eight options along the upper route.

   So there are $8 + 1 = 9$ paths total.

2. (3 points) What is the diameter of the above graph?

   Solution: The diameter is 4. E.g. H and E are four edges apart.

3. (4 points) In the above graph, is there a cycle that contains both node A and node F?

   Solution: Yes, the cycle A, B, C, F, G, K.