

CS 173, Fall 2015  
Examlet 6, Part B

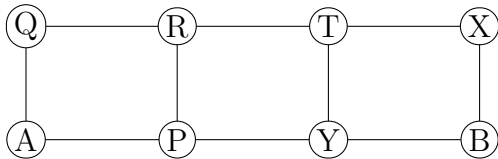
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Discussion: Thursday 2 3 4 5 Friday 9 10 11 12 1 2

1. (9 points) How many paths are there from Q to B in the graph below? Explain or show work.



**Solution:** There are four cases: the path goes through P and then R, through R and then P, just through P, or just through R. In each case, we must then go to T or Y. And then there are two choices of how to finish. So there are a total of 8 paths.

2. (3 points) How many connected components does the above graph have?

**Solution:** One connected component.

3. (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.

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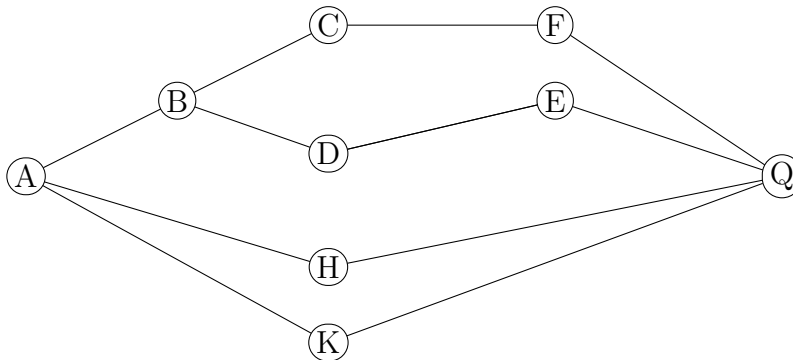
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1. (9 points) How many cycle subgraphs (i.e. subgraphs isomorphic to  $C_n$  for some  $n$ ) does the graph below contain? Count two cycles as the same if they have the same set of nodes; don't worry about (for example) which node is the start/end node. Briefly justify and/or show work.



**Solution:** Six. One is BCFQED. A second is AHQK. Then there are four cycles that choose one of the upper paths from A to Q (AFDEQ or ABCFQ) followed by one of the lower paths from Q to A (QHA or QKA).

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

**Solution:** 3. For example, A and E are three edges apart.

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

**Solution:** Yes, it is bipartite. Put B, E, F, H, K, and A, C, D, Q into the other group. Then all the edges link nodes from different groups.

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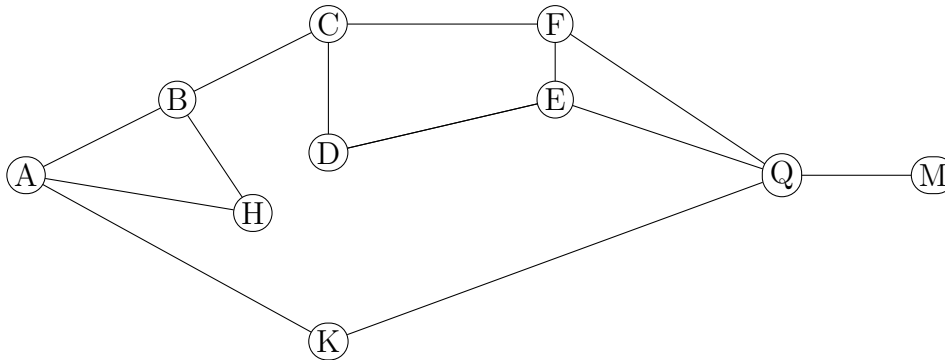
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1. (9 points) How many paths are there from A to Q in the graph below? Explain or show work.



**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 Q. So there are eight options along the upper route.

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

2. (3 points) Does this graph contain a 6-node cycle? Briefly justify your answer

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

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

**Solution:** Yes. The edge QM is a cut edge.

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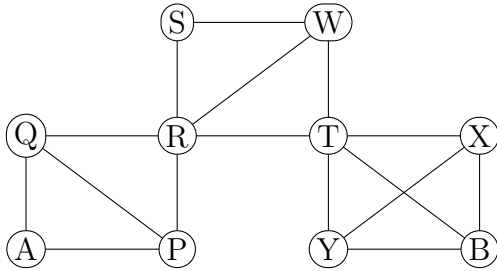
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1. (9 points) How many paths are there from A to B in the graph below? Explain or show work.



**Solution:** There are 4 paths from A to R. Then there are 3 paths from R to T. And 5 paths from T to B. So there are  $4 \cdot 3 \cdot 5 = 60$  paths total.

2. (3 points) How many connected components does the above graph have?

**Solution:** One connected component.

3. (3 points) Does this graph contain a 4-node cycle? Briefly justify your answer

**Solution:** Yes, the cycle APRQ for example.

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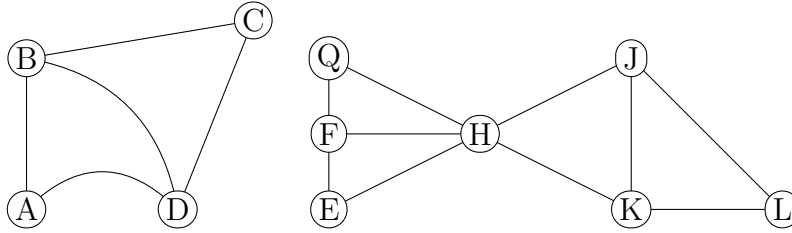
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1. (9 points) How many paths are there from Q to L in the graph below? Explain or show work.



**Solution:** There are three paths from Q to H. Then four paths from H to L. So 12 paths total.

2. (3 points) How many connected components does the above graph have?

**Solution:** This graph has two connected components

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

**Solution:** No. It contains triangles such as B, C, D.

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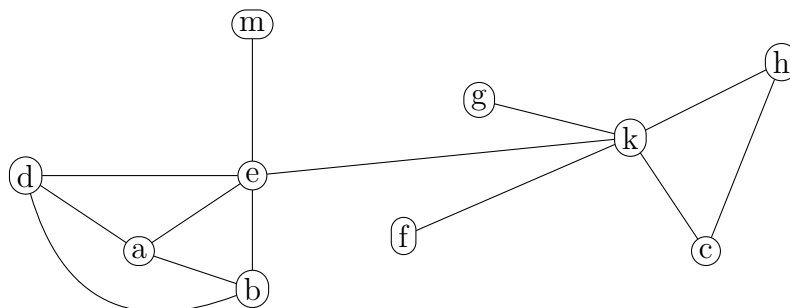
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1. (9 points) How many paths are there from a to h in the graph below? Explain or show work.



**Solution:** There are five paths from a to e: ae, abe, ade, adbe, abde. We must then to go k. Then we have the choice of goign through c or not. So  $5 \cdot 2 = 10$  paths total.

2. (3 points) Does this graph have an Euler circuit? Briefly explain why or why not.

**Solution:** No. Some of the nodes have odd degree.

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

**Solution:** Yes. ek is a cut edge (also other edges like fk).