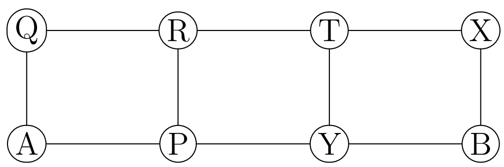
CS 173, Spring 19 Examlet 6, white

Name:____

NetID:________________________ **Lecture:** **A** **B**

Discussion: **Thursday** **Friday** **9** **10** **11** **12** **1** **2** **3** **4** **5** **6**

(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 and the same set of edges. Don't worry about 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 points) Is the above graph acyclic?

Solution: No

(2 points) Does the above graph have an Euler circuit?

Solution: No

(2 points) What is the largest complete (K_n) subgraph of the above graph?

Solution: 2

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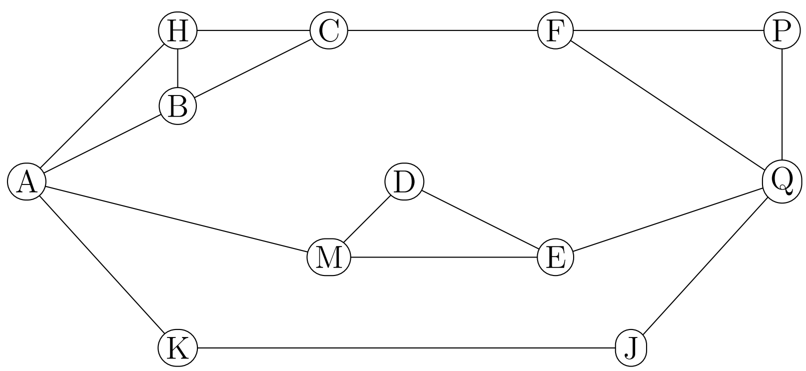
(9 points) How many paths are there from A to Q in the graph below? Explain or show work.



Solution: There are 8 paths across the top (4 ways to get from A to C, 2 ways to get from F to Q). 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 points) Does the above graph contain a 4-node cycle?

Solution: Yes

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

Solution: One

(2 points) What is the largest complete (K_n) subgraph of the above graph?

Solution: 3

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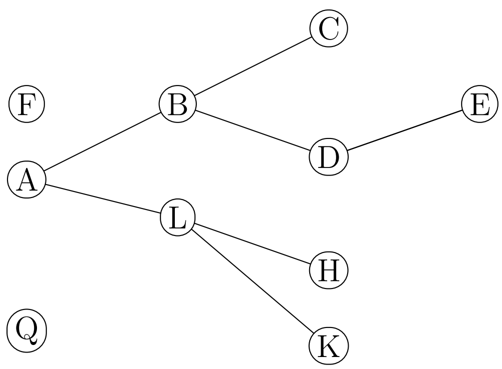
(9 points) In the graph below, how many paths are there from one node to a distinct (aka different) node? Consider all choices of start and end nodes. Explain or show work.



Solution: Nodes F and Q don't connect to any other distinct node.

In the large component, if you pick any two nodes, there is exactly one path between them. There are 8 choices for the start node and 7 choices for the (distinct) end node, so $8 \cdot 7 = 56$ paths.

(2 points) Is the above graph acyclic?

Solution: Yes

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

Solution: Three

(2 points) What is the largest complete (K_n) subgraph of the above graph?

Solution: 2

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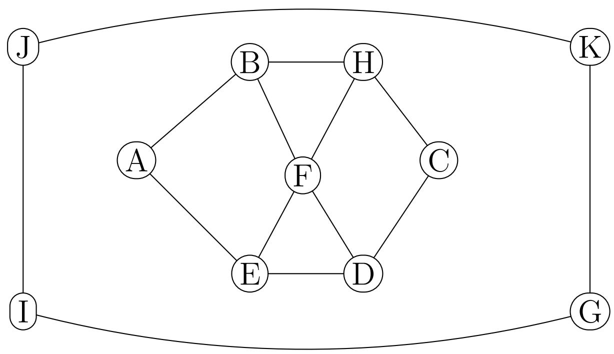
(9 points) How many paths are there from A to C in the graph below? Explain or show work.



Solution: A graph from A to C must go via B or E. There are six ways to get from B to C: BHC, BHFDC, BHFEDC, BFHC, BFDC, BFEDC. Similarly, there are six ways to get from E to C. So there are 12 paths total from A to C.

(2 points) Does the above graph contain a 6-node cycle?

Solution: Yes

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

Solution: Two

(2 points) Is the above graph bipartite?

Solution: No

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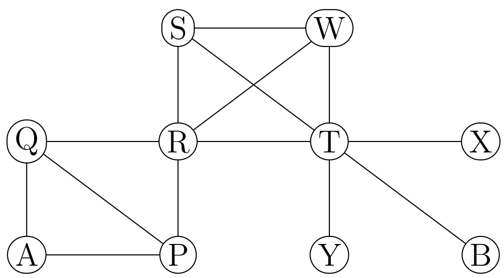
(9 points) How many cycle subgraphs (i.e. subgraphs isomorphic to C_n for some n) does the graph below contain? Count two cycles as the same if they have the same set of nodes and the same set of edges. Don't worry about which node is the start/end node. Briefly justify and/or show work.



Solution: Since a cycle cannot re-use a node, it must live entirely within the set of nodes $\{A, P, Q, R\}$ or the set of nodes $\{R, S, T, W\}$.

In $\{A, P, Q, R\}$, there is one 4-cycle and two 3-cycles.

In $\{R, S, T, W\}$, there are three 4-cycles (SRTWS, SWRTS, STWRS) and four 3-cycles.

So there are a total of 10 cycles in this graph

(2 points) Does the above graph have a cut edge?

Solution: Yes

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

Solution: One

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

Solution: Four

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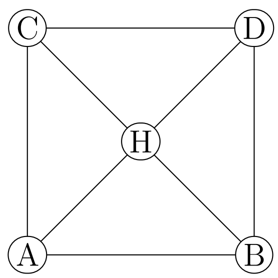
(9 points) How many cycle subgraphs (i.e. subgraphs isomorphic to C_n for some n) does the graph below contain? Count two cycles as the same if they have the same set of nodes and the same set of edges. Don't worry about which node is the start/end node. Briefly justify and/or show work.



Solution: There are four 3-cycles. There are four 4-cycles that are rotations of CDBHC and one four-cycle that doesn't include the hub H.

There are also four 5-cycles: CDBHAC and three rotated versions of it.

So there are either 13 cycles.

(2 points) What is the largest complete (K_n) subgraph of the above graph?

Solution: 3

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

Solution: One

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

Solution: 2

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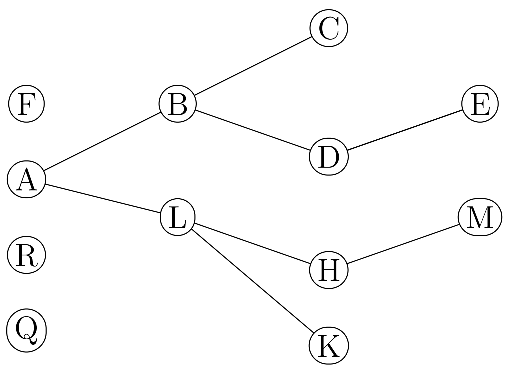
(9 points) How many paths are there in the graph below? Consider all choices of start and end nodes. Explain or show work.



Solution: There are three zero-length paths not in the large component: one using just the node R, on using just the node Q, and one using just the node F.

In the large component, if you pick any two nodes, there is exactly one path between them. Since there are 9 nodes, there are $k \cdot 9 = 81$ paths.

So there are 84 paths total.

(2 points) Is the above graph acyclic?

Solution: Yes

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

Solution: Four

(2 points) Is the above graph bipartite?

Solution: Yes

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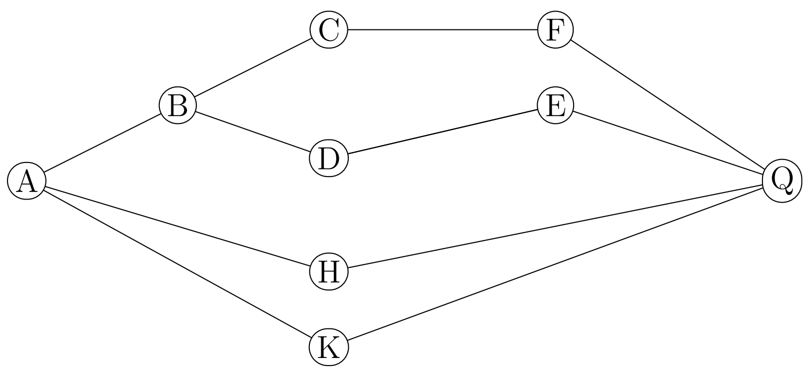
(9 points) How many cycle subgraphs (i.e. subgraphs isomorphic to C_n for some n) does the graph below contain? Count two cycles as the same if they have the same set of nodes and the same set of edges. Don't worry about which node is the start/end node. Briefly justify and/or show work.



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 points) What is the diameter of the above graph?

Solution: 3

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

Solution: One

(2 points) Is the above graph bipartite?

Solution: Yes