My Courses / My courses / Algorithms and Data Structures, MSc (Spring 2023) / Mandatory Activities / Graph terminology

Information

A graph is bipartite if its vertex set can be partitioned into two parts, such that there are no edges between vertices in the same part.

Question 8

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Which graphs are bipartite? (The names are explained in Question 1)

- left a.  $S_n$  for  $n\geq 2$
- $\square$  b.  $W_n$  for  $n\geq 2$
- $leftup C_n$  for even n
- $\square$  d.  $K_n$  for even n
- $leve{ }$  e.  $P_n$  for any  $n\geq 2$
- $\square$  f.  $I_n$  for  $n \geq 2$  (the independent graph on n vertices, which has no edges)
- left g.  $K_{n,m}$  for any  $n\geq 2$  ,  $m\geq 2$
- $ule{\hspace{-0.1cm}\hspace{-0.1cm}\hspace{-0.1cm}}$  h.  $P_2$
- $\Box$  i.  $K_3$

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Question 9

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Recall that an undirected graph is connected if every pair of vertices is connected by a path.

Which claims are true?

- ☐ a. All bipartite graphs are connected
- □ b. Bipartite graphs of 3 or more vertices can never be connected (there must be at least two vertices in one part, which cannot share an edge by definition.)
- ☑ c. We can determine if a bipartite graph is connected by running Depth-First Search from an arbitrary vertex.
- d. We can determine if a bipartite graph is connected by running Union-Find: union all edge endpoints, then check that there is only one component.
- ☐ e. We can determine if a bipartite graph is connected by checking that every vertex in "left" part has at least one incident edge (which must necessarily go to the "right" part.)
- $\Box$  f. We can determine if a bipartite graph is connected by counting the edges. (It must have  $(n/2)^2$  edges.)
- ☑ g. We can determine if a bipartite graph is connected by running Breadth-First Search from an arbitrary vertex.

Ouestion 10

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Let E be the number of edges and V the (total) number of vertices in a bipartite graph.

Let a and b denote the sizes of the two parts.

Select the true statements.

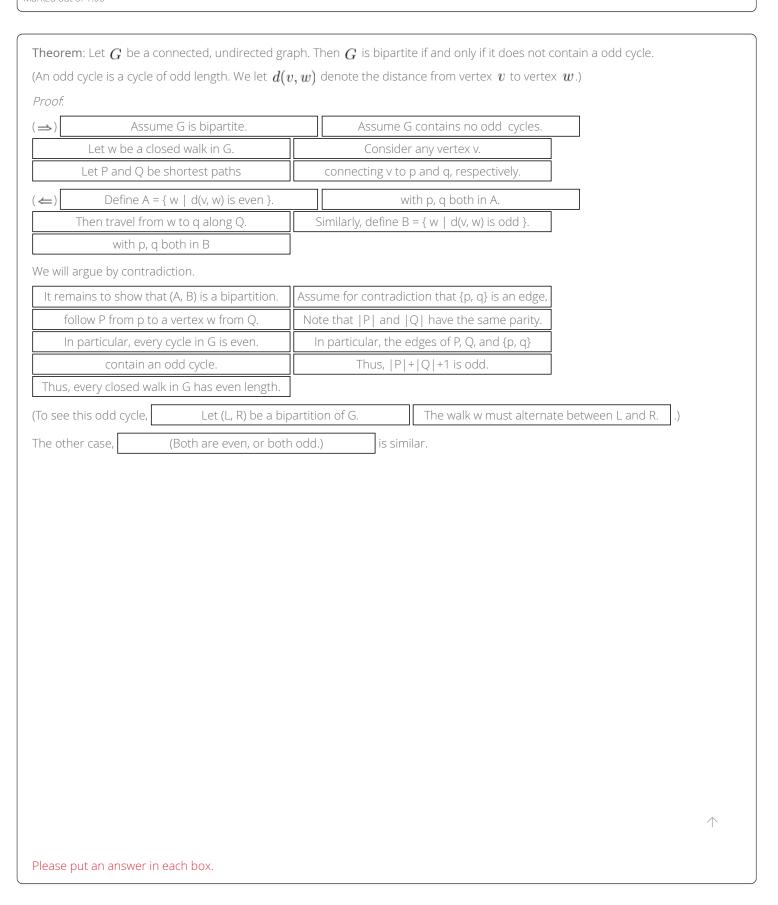
- $\triangleleft$  a. a+b=V
- ightharpoonup b. Possibly,  $E \sim \frac{1}{4} V^2$
- $\square$  c. Possibly,  $E=\frac{1}{2}V^2$
- ightharpoonup d. Possibly, V < E
- ightharpoonup e. It is guaranteed that  $E=O(V^2)$
- $\square$  f. It is guaranteed that V = O(E)
- $\square$  g. It is guaranteed that  $V \sim E$
- $\Box$  h. It must be that a=b



Question 11

Incomplete answer

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Question 12
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Start with 4 vertices and no edges.  Now add 3 random edges, independently and at random.
(To be quite precise, the random process is this: Repeatedly pick an edge from the $\binom{4}{2}$ different pairs of distinct vertices.)
What is the chance that the resulting graph is bipartite?
$\bigcirc$ a. $\frac{1}{9}$

O d.  $\frac{1}{4}$ O e.  $\frac{2}{3}$ O f.  $\frac{1}{2}$ O g.  $\frac{1}{6}$ 

O c. 0

Oh.  $\frac{2}{7}$ 

Clear my choice