2021-016

The answer is **A)**, because only **II)** is correct:

I) False. If the three nodes near the middle of the image and its links are removed, the resulting graph is a disconnected graph and not a bipartite graph.

II) True . The adjacency matrix is:

$$\begin{vmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{vmatrix}$$

And both diagonal are filled only with 0. So, the sum of both ones is 0.

III) False. If the six rightmost nodes of the image and its links are removed, the "Orion's arms" in graph are isolated and indicates that a path visiting each node still passes 2 or more times in a node at least once. Because of this fact, the resulting graph is not Hamiltonian.

IV) False. If the three nodes near the middle and the six rightmost nodes of the image and its links are removed, the resulting graph is still a disconnected graph and not an Eulerian graph.

2021-023

Considering Erdös-Rényi model:

$$p=\frac{\langle k\rangle}{N-1}=\frac{\langle k\rangle}{100-1}=\frac{\langle k\rangle}{99}=0{,}4\Rightarrow\langle k\rangle=0{,}4\times 99=39{,}6$$

As $\langle k\rangle=\frac{2L}{N}$, we discover L value:

$$\langle k\rangle=\frac{2L}{N}=\frac{2L}{100}=39{,}6\Rightarrow L=\frac{39{,}6\times 100}{2}=\frac{3960}{2}=1980$$

The **Two nodes are connected**. expression brings some ambiguity, but considering that is related to the probability and not to the network, the answer is **D)**.