# Homework VIII: Graph Connectivity and Structural Similarity

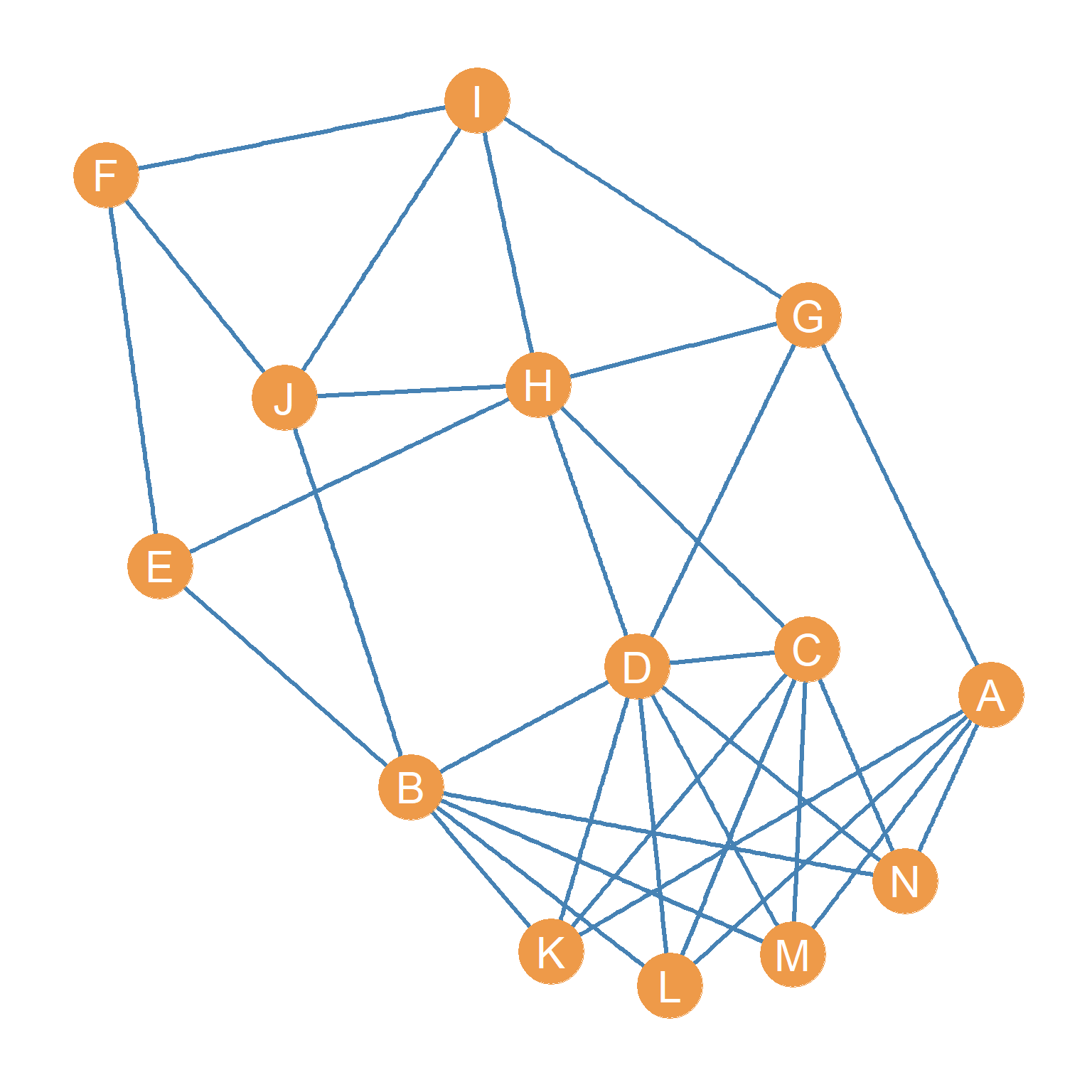


Figure 1: An undirected graph.

In the matrix below, write down the cell entries for the **adjacency matrix** corresponding to the graph shown in [Figure 1](#fig-grex1):

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
| A | ---- |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B |  | ---- |  |  |  |  |  |  |  |  |  |  |  |  |
| C |  |  | ---- |  |  |  |  |  |  |  |  |  |  |  |
| D |  |  |  | ---- |  |  |  |  |  |  |  |  |  |  |
| E |  |  |  |  | ---- |  |  |  |  |  |  |  |  |  |
| F |  |  |  |  |  | ---- |  |  |  |  |  |  |  |  |
| G |  |  |  |  |  |  | ---- |  |  |  |  |  |  |  |
| H |  |  |  |  |  |  |  | ---- |  |  |  |  |  |  |
| I |  |  |  |  |  |  |  |  | ---- |  |  |  |  |  |
| J |  |  |  |  |  |  |  |  |  | ---- |  |  |  |  |
| K |  |  |  |  |  |  |  |  |  |  | ---- |  |  |  |
| L |  |  |  |  |  |  |  |  |  |  |  | ---- |  |  |
| M |  |  |  |  |  |  |  |  |  |  |  |  | ---- |  |
| N |  |  |  |  |  |  |  |  |  |  |  |  |  | ---- |

Using the information from the previous matrix, in the matrix below, write down the cell entries for the **structural similarity matrix** corresponding to the graph shown in [Figure 1](#fig-grex1) using the **Euclidean Distance**:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
| A | ---- |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B |  | ---- |  |  |  |  |  |  |  |  |  |  |  |  |
| C |  |  | ---- |  |  |  |  |  |  |  |  |  |  |  |
| D |  |  |  | ---- |  |  |  |  |  |  |  |  |  |  |
| E |  |  |  |  | ---- |  |  |  |  |  |  |  |  |  |
| F |  |  |  |  |  | ---- |  |  |  |  |  |  |  |  |
| G |  |  |  |  |  |  | ---- |  |  |  |  |  |  |  |
| H |  |  |  |  |  |  |  | ---- |  |  |  |  |  |  |
| I |  |  |  |  |  |  |  |  | ---- |  |  |  |  |  |
| J |  |  |  |  |  |  |  |  |  | ---- |  |  |  |  |
| K |  |  |  |  |  |  |  |  |  |  | ---- |  |  |  |
| L |  |  |  |  |  |  |  |  |  |  |  | ---- |  |  |
| M |  |  |  |  |  |  |  |  |  |  |  |  | ---- |  |
| N |  |  |  |  |  |  |  |  |  |  |  |  |  | ---- |

1. Using the Information in the previous matrix, write down the set of nodes that are **structurally equivalent** (e.g., connected to the same set of neighbors) in the graph shown in [Figure 1](#fig-grex1).
2. Out of the nodes that are not structurally equivalent, which pairs of nodes have the highest **structural similarity** in the graph shown in [Figure 1](#fig-grex1)?
3. Using the **Jaccard Similarity** metric, compute the structural similarity between nodes *B* and *D* in the graph shown in [Figure 1](#fig-grex1).
4. Using the **Dice Similarity** metric, compute the structural similarity between nodes *C* and *D* in the graph shown in [Figure 1](#fig-grex1).
5. Using the **Cosine Similarity** metric, compute the structural similarity between nodes *A* and *C* in the graph shown in [Figure 1](#fig-grex1).
6. Write down a **node cut set** for the graph shown in [Figure 1](#fig-grex1).
7. Write down an **edge cut set** for the graph shown in [Figure 1](#fig-grex1).
8. What is the **k-connectivity** of the graph?
9. What is the **edge connectivity** of the graph?
10. What is the **pairwise k-connectivity** between nodes *E* and *G*?