# Homework IV: Indirect Connections and Matrices

## Indirect Connections

Consider the graph shown in Figure [Figure 1](#fig-grex1):

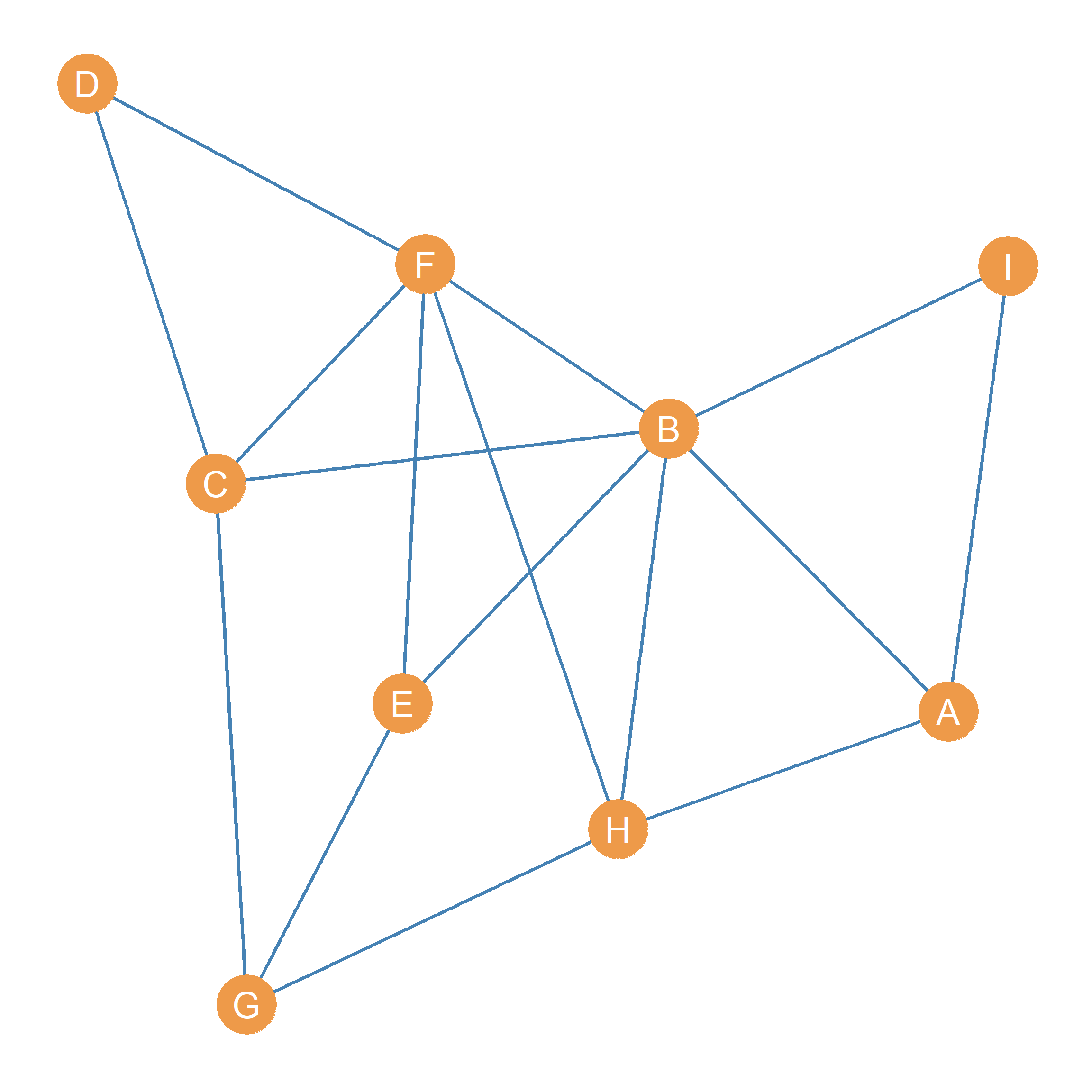


Figure 1: An undirected graph.

1. Write down *all* the **paths** connecting node *A* and node *D*:
2. Write down *all* the **paths** of length two (\(l = 2\)) featuring node *B* as the **inner node**:
3. Write down the the **shortest path(s)** connecting nodes *G* and *I*:
4. Write down *every* that **cycle** starts and ends with node *F*:

## Directed Paths

Consider the graph shown in [Figure 2](#fig-grex2):

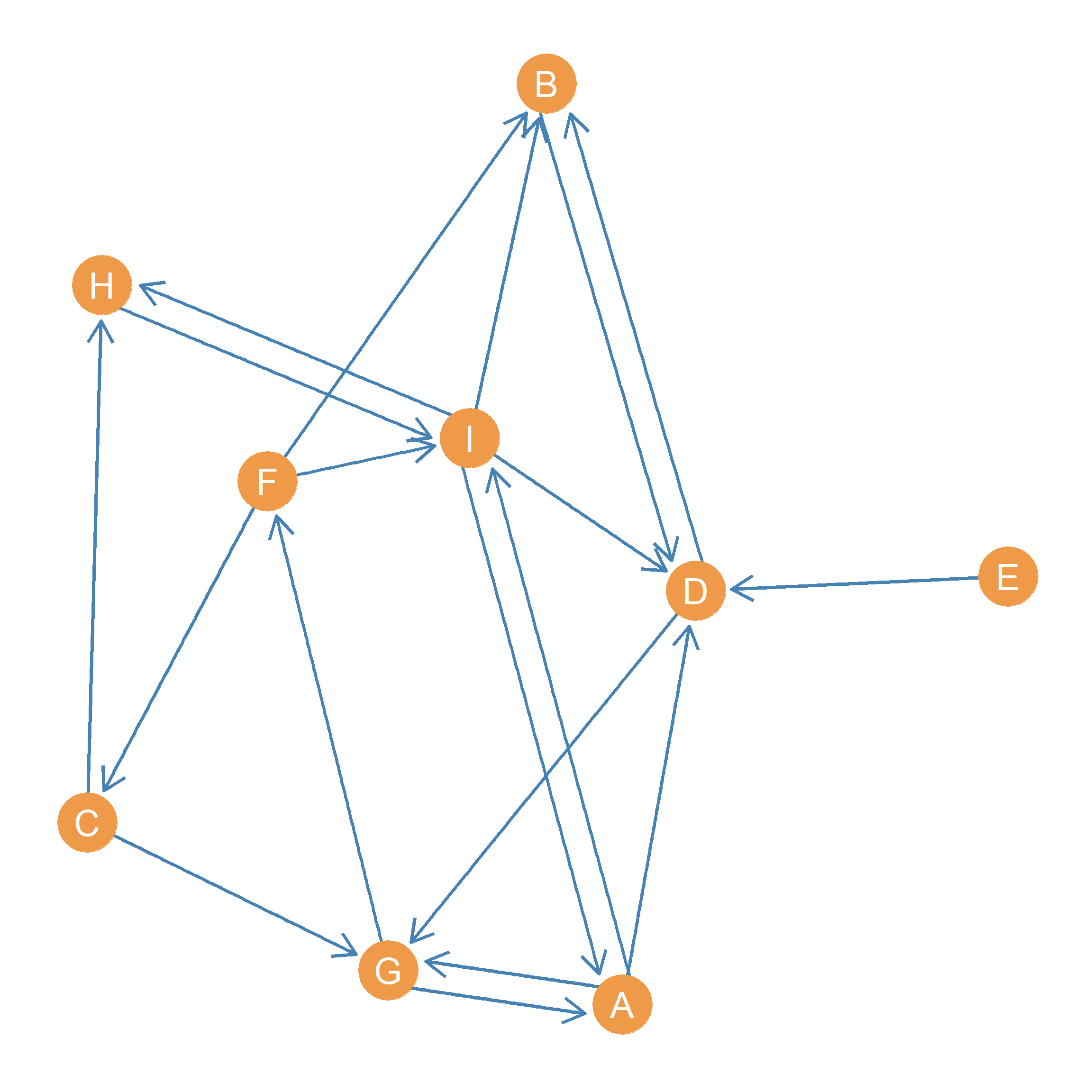


Figure 2: A directed graph.

1. Write down *all* the **directed path(s)** going *from* node *G* *to* node *B*:
2. What is the length of the **shortest directed path(s)** connecting going *from* node *A* *to* node *C*?
3. If *B* wanted to send a message to *H* in the most efficient way, how many intermediaries would *B* have to use?
4. Write down *every* that **cycle** starts and ends with node *D*:

## Matrices

* In the matrix below, write down the cell entries for the **adjacency matrix** corresponding to the graph shown in [Figure 2](#fig-grex2):

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | E | F | G | H | I |
| A | ---- |  |  |  |  |  |  |  |  |
| B |  | ---- |  |  |  |  |  |  |  |
| C |  |  | ---- |  |  |  |  |  |  |
| D |  |  |  | ---- |  |  |  |  |  |
| E |  |  |  |  | ---- |  |  |  |  |
| F |  |  |  |  |  | ---- |  |  |  |
| G |  |  |  |  |  |  | ---- |  |  |
| H |  |  |  |  |  |  |  | ---- |  |
| I |  |  |  |  |  |  |  |  | ---- |

* In the matrix below, write down the cell entries for the **reachability matrix** corresponding to the graph shown in [Figure 2](#fig-grex2):

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | E | F | G | H | I |
| A | ---- |  |  |  |  |  |  |  |  |
| B |  | ---- |  |  |  |  |  |  |  |
| C |  |  | ---- |  |  |  |  |  |  |
| D |  |  |  | ---- |  |  |  |  |  |
| E |  |  |  |  | ---- |  |  |  |  |
| F |  |  |  |  |  | ---- |  |  |  |
| G |  |  |  |  |  |  | ---- |  |  |
| H |  |  |  |  |  |  |  | ---- |  |
| I |  |  |  |  |  |  |  |  | ---- |

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

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | E | F | G | H | I |
| A | ---- |  |  |  |  |  |  |  |  |
| B |  | ---- |  |  |  |  |  |  |  |
| C |  |  | ---- |  |  |  |  |  |  |
| D |  |  |  | ---- |  |  |  |  |  |
| E |  |  |  |  | ---- |  |  |  |  |
| F |  |  |  |  |  | ---- |  |  |  |
| G |  |  |  |  |  |  | ---- |  |  |
| H |  |  |  |  |  |  |  | ---- |  |
| I |  |  |  |  |  |  |  |  | ---- |

* What is the **diameter** of the graph shown in [Figure 1](#fig-grex1)?