BSCMA1001: Activity Questions
Week-10
Graphs

Contents

1 Lecture-1

I Multiple Choice Questions (MCQ):

1. Which of the following statements is true for an undirected planar graph with 169 vertices?

    1. Number of edges will be less than or equal to 14196.
    2. Number of edges will be less than or equal to 14281.
    3. Number of edges will be less than or equal to 169.
    4. Number of edges will be less than or equal to 28382.

2 Lecture-2

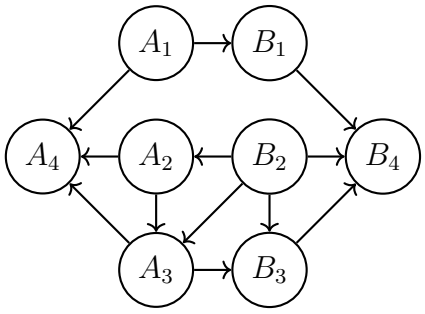
I Multiple Choice Questions (MCQ):

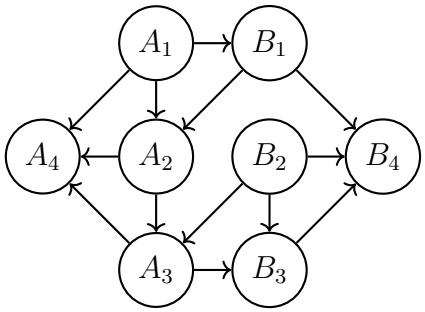
1. The entry and its dependencies in a cell for any spreadsheet can be represented using direct acyclic graphs. Table AQ-10.0 shows a small part of a spreed sheet. The particular cell in a spreed sheet can be represented as X_i, where X represents the column and i represents the row number. The entry A_1^2 in cell B_1 means B_1 has the value A_1^2, where A_1 is the value in column A row 1.

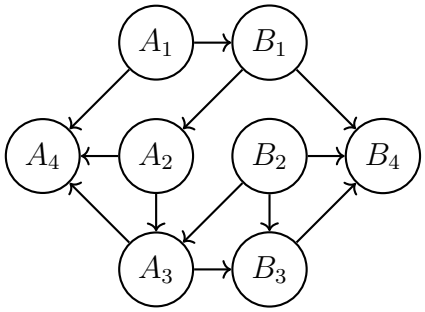
	A	B
1	A_1	A_1^2
2	$B_1 - 10$	B_2
3	$A_2 + B_2$	B_2/A_3
4	$A_1 + A_2 + A_3$	$B_1 + B_2 + B_3$

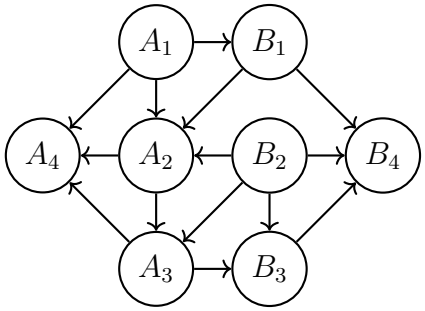
Table AQ-10.0

(a) Which of the following graphs represents the dependencies between cells in the table AQ-10.0 [Ans: Option 3]

1. 

2. 

3. 

4. 

(b) If the value of B_1 increases by 10 times, then the value of B_2.

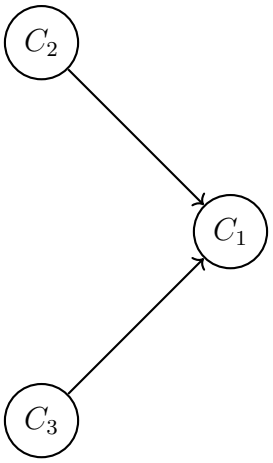
1. Will not change.
2. Will change but we do not know by how much.
3. Will also increase by 10 times.
4. Will decrease by 10 times.

(c) If there is a change in value of B_2, then the reason is.

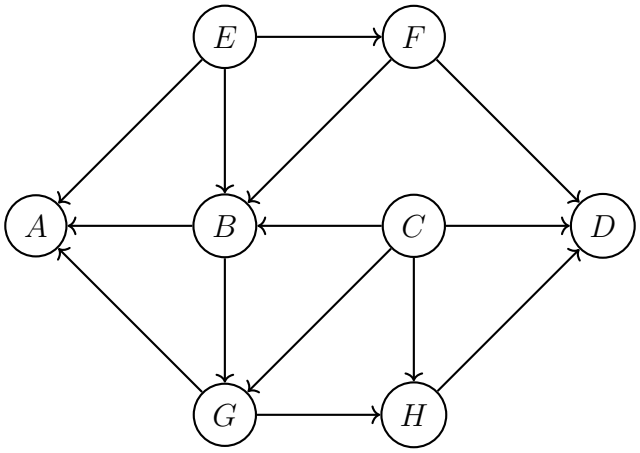
1. Change in value of B_4.
2. Change in value of B_3.
3. Change in value of A_2.
4. None of the above.

II Multiple Select Questions (MSQ):

2. If a chemical C_1 is prepared using chemicals C_2 and C_3, then we can represent this using graphs as shown below.



A chart is shown using graphs for different types of chemicals being prepared in a factory. Choose the correct option(s) based on the graph.



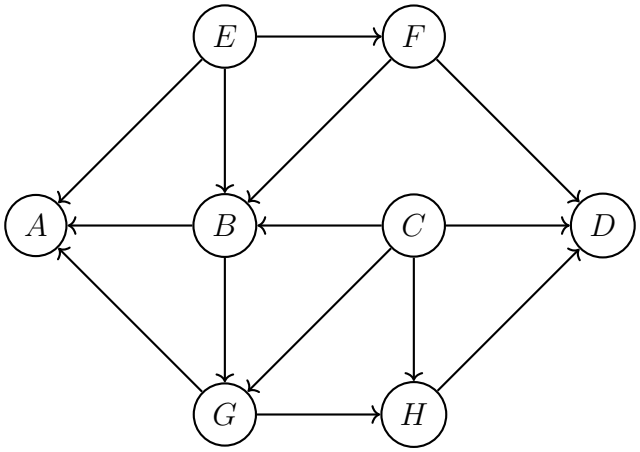
Options:

1. The given graph is an example of an directed acyclic graph.
2. The given graph is an example of a directed cyclic graph.
3. The given graph is an example of an undirected cyclic graph.
4. F and E are the initial raw material (which the factory does not produce).
5. C and E are the initial raw materials (which the factory does not produce).
6. The quality of chemical C depends on the qualities of D, G, and H.
7. The qualities of chemicals D, G, and H depend on the quality of C.
8. If there is an impurity in G, it means there was an impurity in E definitely.
9. If there is an impurity in G, it means there might be an impurity in E.

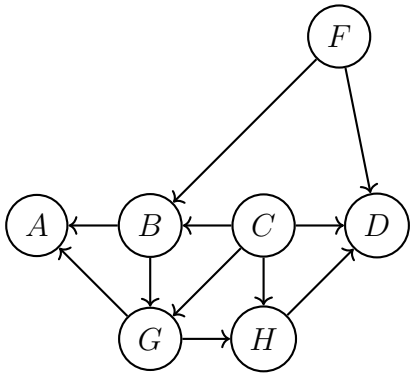
3 Lecture-3

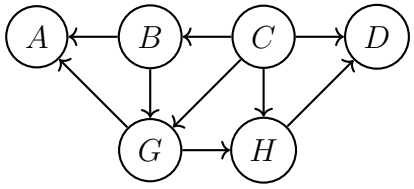
I Multiple select Questions (MSQ):

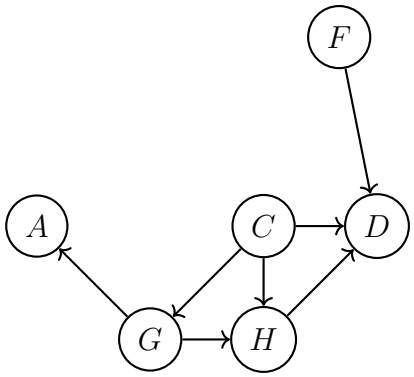
Answer the following questions based on the graph shown below.

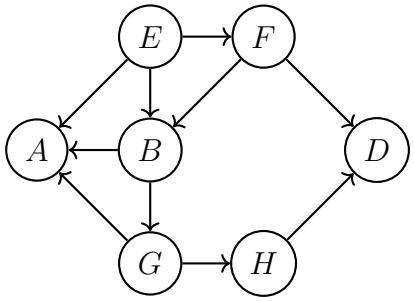


1. What are the resulting graphs after removing the first node during topological sorting. [Ans: option 1 and 4]

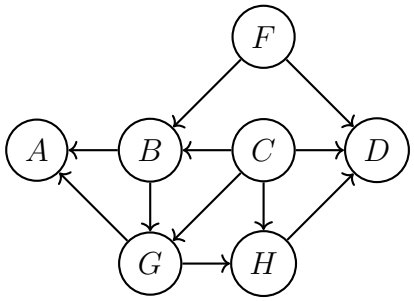
1. 

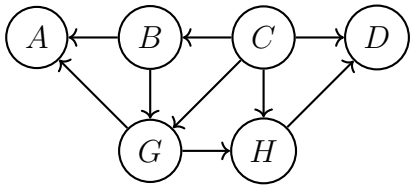
2. 

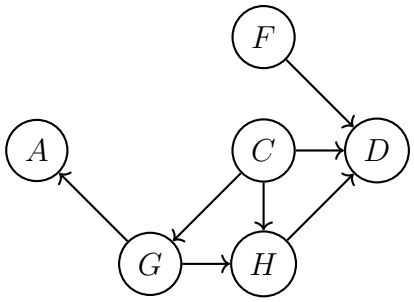
3. 

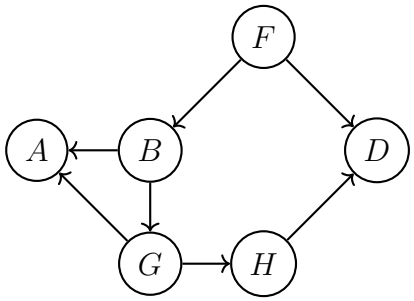
4. 

2. What is the resulting graph after removing the first two nodes during topological sorting. [Ans: option 2 and 4]

1. 

2. 

3. 

4. 

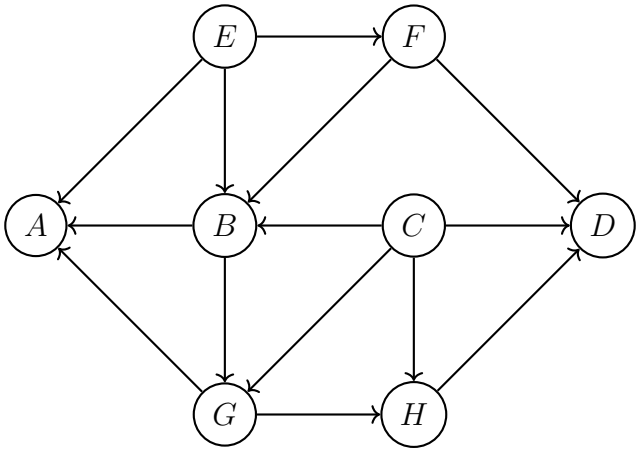
3. Which of the following are valid topological orders for this graph?

    1. $E, F, C, B, G, A, H, D.$
    2. $E, C, B, F, A, G, H, D.$
    3. $E, C, F, B, G, A, H, D.$
    4. $C, F, E, B, A, G, H, D.$
    5. $C, E, F, B, G, A, H, D.$
    6. $E, C, F, B, D, H, H, F.$

4 Lec 4

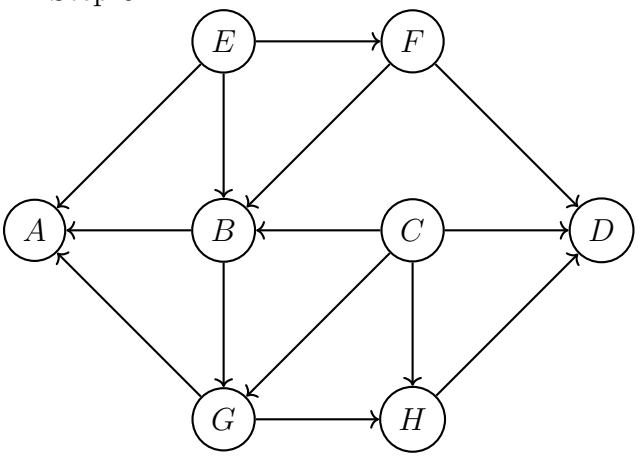
I Multiple Choice Questions (MCQ):

Answer the following questions based on the graph shown below.



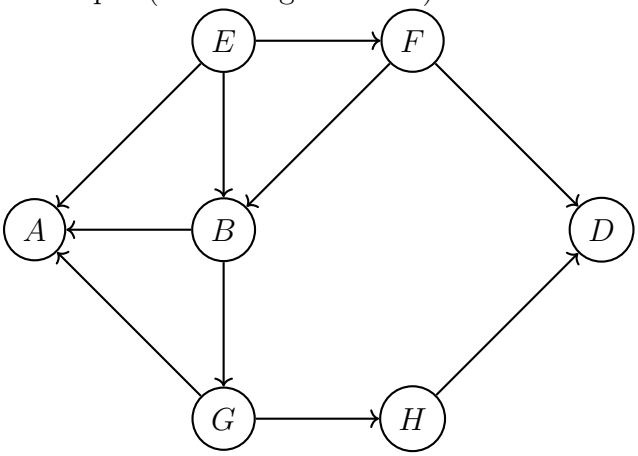
One possible topological order could be C, E, F, B, G, A, H, D, and the steps are mentioned below along with the longest path computation.
Note: L.P. refers to longest path.

Step 0:



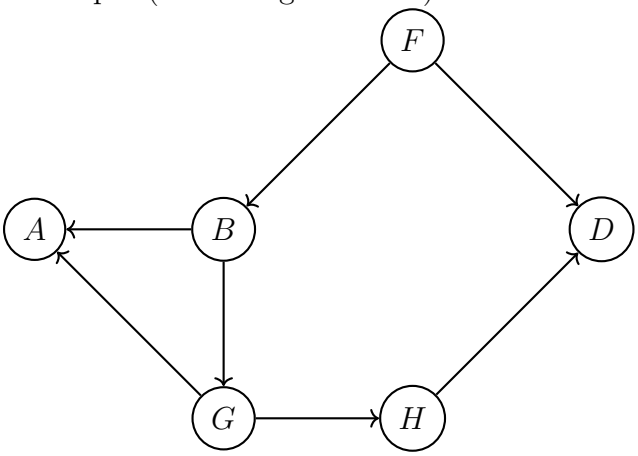
Nodes	A	B	C	D	E	F	G	H
Indegree	3	3	0	3	0	1	2	2
L. P.	0	0	0	0	0	0	0	0

Step 1 (Removing node 'C'):



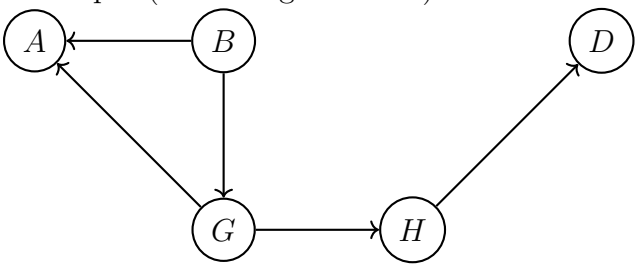
Nodes	A	B	C	D	E	F	G	H
Indegree	3	2	-	2	0	1	1	1
L. P	0	1	0	1	0	0	1	1

Step 2 (Removing node 'E'):



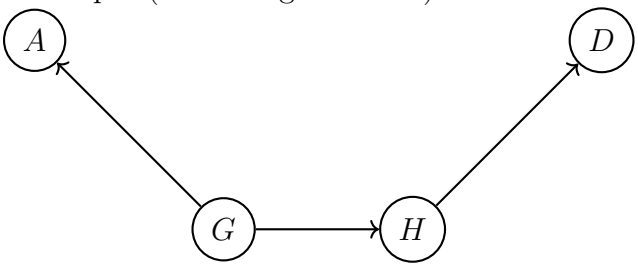
Nodes	A	B	C	D	E	F	G	H
Indegree	2	1	-	2	-	0	1	1
L. P	1	1	0	1	0	1	1	1

Step 3 (Removing node 'F'):



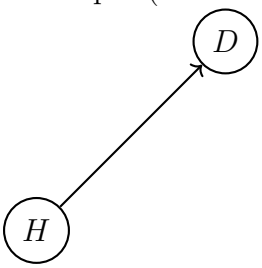
Nodes	A	B	C	D	E	F	G	H
Indegree	2	0	-	1	-	-	1	1
L. P	1	2	0	2	0	1	1	1

Step 4 (Removing node 'B'):



Nodes	A	B	C	D	E	F	G	H
Indegree	1	-	-	1	-	-	1	1
L. P	2	2	0	2	0	1	3	1

Step 5 (Removing node 'G'):



Nodes	A	B	C	D	E	F	G	H
Indegree	-	-	-	1	-	-	-	0
L. P	4	2	0	2	0	1	3	4

Step 6 (Removing node 'H'):

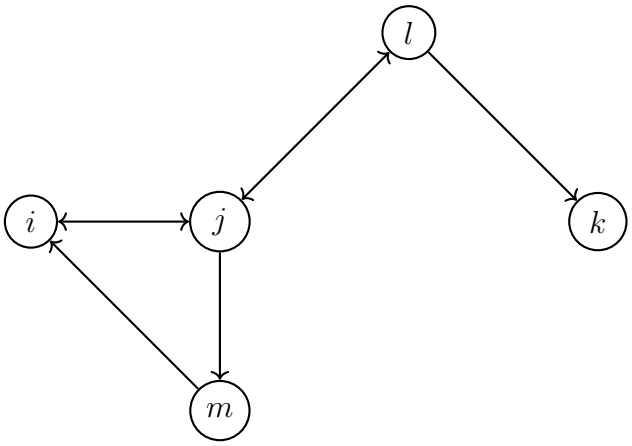
Nodes	A	B	C	D	E	F	G	H
Indegree	-	-	-	-	-	-	-	-
L. P	4	2	0	5	0	1	3	4

1. Which of the following is an error in the computation above?
    1. Step 4- indegree of A.
    2. Step 4- Longest path of A.
    3. Step 5- indegree of D.
    4. Step 5- Longest path of D.
2. There are two possible topological order E, C, F, B, G, A, H, D and C, E, F, B, G, A, H, D. The longest path for G will be.
    1. Different in both the cases.
    2. Same in both the cases
    3. impossible to find.
    4. None of the above.

5 Lec 5

I Multiple Choice Questions (MCQ):

Answer the following questions based on the given information below.
A directed graph and corresponding adjacency matrix (A or A^1) is shown in the figure.



	i	j	k	l	m
i	0	1	0	0	0
j	1	0	0	1	1
k	0	α	β	0	0
l	0	1	1	0	0
m	1	0	0	0	0

1. What are the values of α and β?

    1. $\alpha = 1,\ \beta = 0$
    2. $\alpha = 1,\ \beta = 1$
    3. $\alpha = 0,\ \beta = 1$
    4. $\alpha = 0,\ \beta = 0$

2. A^2 (as discussed in lecture) is created based on the adjacency matrix. What are the values of α and β?

	i	j	k	l	m
i	1	0	0	α	1
j	1	1	1	0	0
k	0	0	β	0	0
l	α	0	0	1	1
m	0	α	0	0	0

    1. $\alpha = 1,\ \beta = 0$
    2. $\alpha = 0,\ \beta = 0$
    3. $\alpha = 1,\ \beta = 1$
    4. $\alpha = 0,\ \beta = 1$

6 Lec 6

I Multiple Select Questions (MCQ):

1. Given the following matrices A and B.

$$A = \begin{pmatrix} 1 & 0 & 3 \\ 2 & 5 & 0 \\ 0 & 8 & 0 \end{pmatrix} \qquad B = \begin{pmatrix} 0 & 2 & 3 \\ 4 & 0 & 6 \\ 7 & 0 & 4 \end{pmatrix}$$

Which of the following represents the product $C = A \times B$? [Ans: option c]

1. $$C = \begin{pmatrix} 21 & 2 & 15 \\ 20 & 4 & 36 \\ 3 & 0 & 9 \end{pmatrix}$$
2. $$C = \begin{pmatrix} 21 & 2 & 15 \\ 20 & 4 & 36 \\ 32 & 0 & 9 \end{pmatrix}$$
3. $$C = \begin{pmatrix} 21 & 2 & 15 \\ 20 & 4 & 36 \\ 32 & 0 & 48 \end{pmatrix}$$
4. $$C = \begin{pmatrix} 21 & 2 & 15 \\ 20 & 4 & 36 \\ 32 & 0 & 52 \end{pmatrix}$$

Answer the questions 2 and 3 based on the adjacency matrix (A or A^1) given below.

	i	j	k	l	m
i	0	α	0	0	1
j	0	0	1	0	1
k	0	0	β	1	0
l	0	0	0	0	1
m	0	0	0	0	0

2. We use matrix multiplication to find A^2 (shown below). What are the values of α and β?

	i	j	k	l	m
i	0	0	1	0	1
j	0	0	0	1	0
k	0	0	0	0	1
l	0	0	0	0	0
m	0	0	0	0	0

    1. $\alpha = 1,\ \beta = 0$
    2. $\alpha = 0,\ \beta = 0$
    3. $\alpha = 1,\ \beta = 1$
    4. $\alpha = 0,\ \beta = 1$

3. Mark all correct statements below.
   Hint: $A^3 = A^2 \times A$ and $A^4 = A^2 \times A^2$.

    1. There is path of length 5 from i to reach m.
    2. There is path of length 4 from i to reach m.
    3. There is path of length 3 from i to reach m.
    4. There is path of length 2 from i to reach m.
    5. There is path of length 1 from i to reach m.