In [4]:
```
### CSCI-3080 Discrete Structure
### OLA 4: Chapter 5 -- Matrix, Chapter 6 -- Graphs and Trees
### Name:
### Student ID:
### Date:
### Total: 100 Points
```

1. Please use Gaussian Elimination to solve the system of equations. (5 points)

```
x + 5y = 1
2x - 3y = 15
```

Note: Please show all gaussian elimination steps.

In [ ]:

2. For Regular Matrices: (6 points, 2 points + 4 points)

$$A = \begin{bmatrix} 2 & 1 \\ -1 & 0 \\ 3 & 4 \end{bmatrix} \qquad B = \begin{bmatrix} 4 & 1 & 2 \\ 6 & -1 & 5 \\ 1 & 3 & 2 \end{bmatrix}$$

Please compute $A \cdot B$, and $B \cdot A$ if possible.

Note: Only need to show the final result.

In [ ]:

3. For Boolean Matrices: (12 points, each 4 points)

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

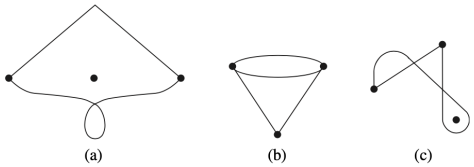
Please find $A \wedge B$, $A \vee B$, and $A \times B$

Note: Only need to show the final result.

In [ ]:

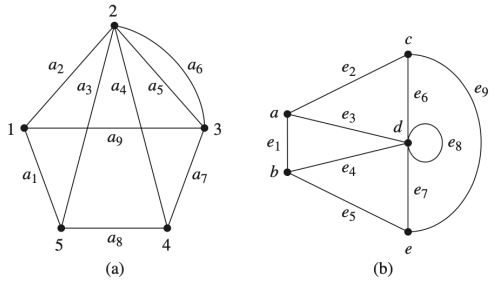
4. Please answer the following two isomorphic graph quesitons. (5 points)

(1) Which of the following graphs is not isomorphic to the others, and please write down the reason why? (2.5 points)



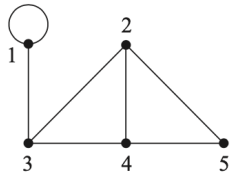
In [ ]:

(2) Decide if the two graphs are isomorphic. If so, give the function or functions that establish the isomorphism; if not, explain why. (2.5 points)



In [ ]:

5. Write the adjacency matrix for the given graph. (8 points)



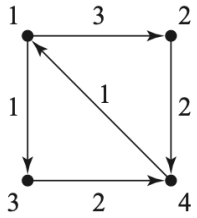
In [ ]:

6. Draw the weighted graph represented by the following adjacency matrix. (5 points)

$$\begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 \\ 0 & 0 & 0 & 0 & 2 & 0 \end{pmatrix}$$

In [ ]:

7. Write the adjacency list representation for the given weighted directed graph. (8 points)



In [ ]:

8. Please draw the expression binary tree for the following algebraic expression: (20 points)

$$[(x - 2) * 3] + (5 + 4)$$

(1) Please draw the expression binary tree (**5 points**)

(2) Write the list of nodes resulting from a **Preorder** traversal, an **Inorder** traversal, and a **Postorder** traversal of the given tree (**15 points**)

In [ ]:

9. Given the codes: (6 points)

character	b	h	q	w	%
encoding	1000	1001	0	11	101

(1) Please decode the sequence 10001001101101 (**2 points**)

(2) Please decode the sequence 11110 (**2 points**)

(3) Please decode the sequence 01001111000 (**2 points**)

In [ ]:

10. Given the characters and frequency: (25 points)

Character	?	x	w	e	t	s	a
Frequency	14	3	11	27	18	22	5

(1) Please construct the **Huffman tree** for the above characters and frequencies. (**10 points**)
Note: please show all the steps

(2) Please find the **Huffman code** for each character. (**7 points**)

(3) A file consisting of 10,000 instances of these seven characters is stored using a **fixed-length** binary encoding scheme. How many bits are required for each character? and what is the toal number of bits needed for this file? (**2 points**)

(4) Storing the same file using the **ASCII code** encoding scheme. How many bits are required for each character? and what is the toal number of bits needed for this file? (**2 points**)

(5) Storing the same file using the **Huffman code** in (2), how many bits are needed in total? (**4** points)
Note: please show all the calculation steps

In [ ]:

In [ ]: