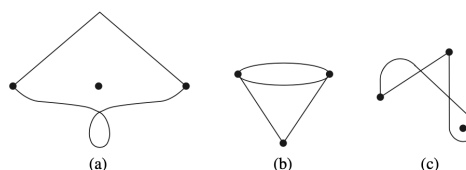In [1]: *### CSCI-3080 Discrete Structure*
OLA 7: Chapter 6 -- Graphs and Trees
Name:
Student ID:
Date:

1. Which of the following graphs is not isomorphic to the others, and why?

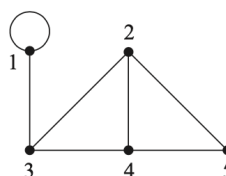(a)   (b)   (c)

b is not isomorphic to the others. Because b doesnot have an isolated node. a and c do have an isolated node.

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

(a)   (b)
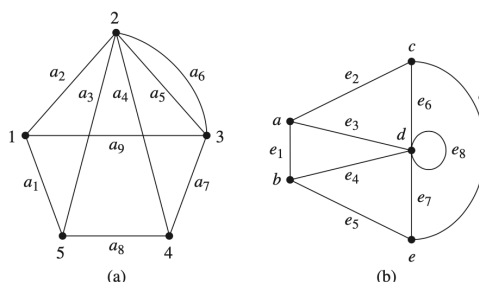
They are not isomorphic, because graph b has a loop and graph a does not.

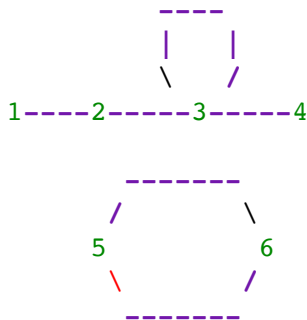## 3. Write the adjacency matrix for the given graph.

$$\begin{pmatrix} 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{pmatrix}$$
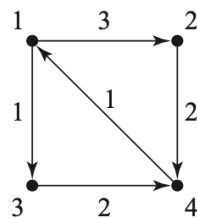
4. Draw the graph represented by the adjacency matrix.

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

```
In [ ]:            ----
                  |    |
                   \   /
          1----2-----3-----4

                -------
               /       \
              5         6
               \       /
                -------
```

5. Write the adjacency list representation for the given weighted directed graph.
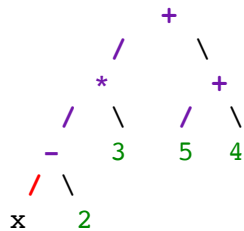
```
In [ ]:  1|  |-->|2|3|  |-->|3|1|.|
         2|  |-->|4|2|.|
         3|  |-->|4|2|.|
         4|  |-->|1|1|.|
```

6. Please draw the expression tree for the expression:

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

1. Please draw the expression binary tree
2. Write the list of nodes resulting from a **preorder** traversal, an **inorder** traversal, and a **postorder** traversal of the given tree

```
In [ ]:                  +
                      /      \
                    *          +
                  /  \       /  \
                -     3     5    4
              / \
            x     2
```

```
In [ ]:  preorder:   + * - x 2 3 + 5 4
         inorder:    x - 2 * 3 + 5 + 4
         postorder:  x 2 - 3 * 5 4 + +
```

7. Given the codes:

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

(1) decode the sequence 10001001101101
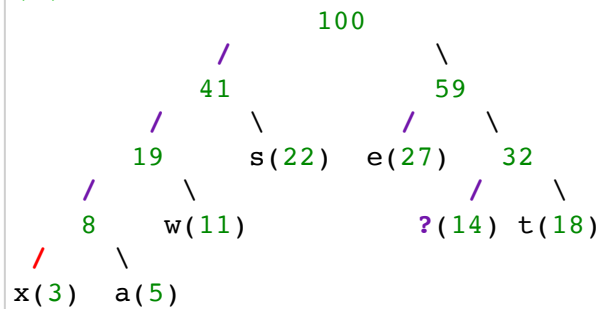(2) decode the sequence 11110
(3) decode the sequence 01001111000

(1) b h % % (2) w w q (3) q h w b

8.

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

(1) Please construct the Huffman tree for the following characters and frequencies.
(2) Please find the Huffman codes for these characters.
(3) A file consisting of 100,000 instances of these seven characters is stored using a fixed-length binary encoding scheme. How many bits are required for each code and what is the toal number of bits needed?
(4) Storing the same file using the Huffman code in (2), how many bits are needed?

In [ ]: (1)
```
                    100
              /           \
           41              59
         /     \         /     \
       19      s(22)  e(27)    32
      /    \                 /     \
     8     w(11)          ?(14) t(18)
    /   \
  x(3)  a(5)
```

In [ ]: (2)
```
? 110
x 0000
w 001
e 10
t 111
s 01
a 0001
```

In [ ]: (3)
```
There are 7 different characters. 2^3 = 8. We need 3 bits for the fixed-len
binary encoding scheme. In total, it needs 3*100,000 = 300,000 bits
```

In [ ]: (4)
```
?: 3*100000*0.14 = 42000
x: 4*100000*0.03 = 12000
w: 3*100000*0.11 = 33000
e: 2*100000*0.27 = 54000
t: 3*100000*0.18 = 54000
s: 2*100000*0.22 = 44000
a: 4*100000*0.05 = 20000

total: 42000 + 12000 + 33000 + 54000 + 54000 + 44000 + 20000 = 259000
```