1. (6 marks)

(a) Draw a minimum spanning tree of the graph G below.

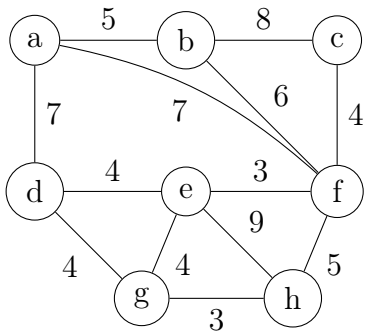
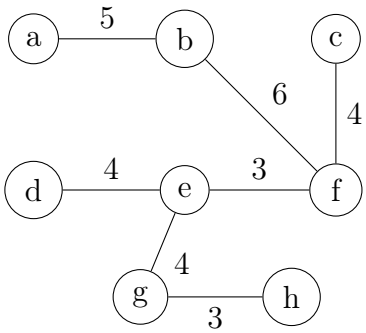


Figure 1: Graph G



(b) What is the weight of the minimum spanning tree?

29

(c) Does the graph G in the Figure above contain an Eulerian circuit? If yes, give it, otherwise explain why not.

No as there exists a vertex with an odd degree.

2. (3 marks)
Circle True or False for (a) and circle the correct Python evaluation (True or False) for each of the following Boolean statements (b)–(f):

(a) Algorithms must have an input

A. True

B. False

B

(b)
```
14/5 == (14 - 14%5)//5
```

A. True

B. False

B

(c)
```
S = "Hello"
S[-2:]  == "eH"
```

A. True

B. False

B

(d)
```
2 ** 3 * 2 == 2 ** 6
```

A. True

B. False

B

(e)
```
s = "Hello"
s.lower()
s == "hello"
```

A. True

B. False

B

(f)
```
'3'in [1,2,3]
```

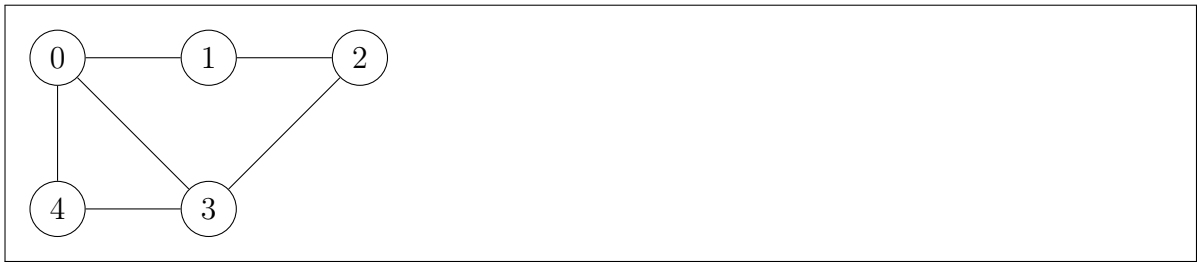
A. True

B. False

B

3. (4 marks) Draw the graph described by the adjacency matrix below

	0	1	2	3	4
0	0	1	0	1	1
1	1	0	1	0	0
2	0	1	0	1	0
3	1	0	1	0	1
4	1	0	0	1	0



4. (2 marks)

(a) Which of the following is not a valid variable name in Python?

A. `max_import`
B. `maxImport`
C. `max`
D. `import`

D

(b) Which of the following is not a string in Python?

A. `"hello"`
B. `'hello'`
C. `''`
D. `hello`

D

5. (8 marks)
For each of the following fragments of Python code, write what would be printed by the print statements in each program.

(a)
```
S = "FIT1045"
print(len(S))
print(2 * S[2:3])
print("S" not in S)
```

```
7
TT
True
```

(b)
```
x = 0
for i in range(-5, 4, 2):
  if i % 2 == 0:
    x = x + 1
print(x)
```

```
0
```

(c)
```
L = [2,4,6,8,10]
val = 0
for a, b in enumerate(L):
  val = val + a * b
print(val)
```

```
80
```

(d)
```
s = "cat"
L = [1,2,3]
for item in L:
  print(item * s)
```

```
cat
catcat
catcatcat
```

6. (6 marks)

(a) Sort the list $[19, -8, 15, 8, 3, -3]$ into increasing order using **selection sort**. You should write the list in the table below after each iteration of the main loop in this algorithm.

19	-8	15	8	3	-3

```
-8  15  19   8   3  -3
-8  -3  19   8   3  15
-8  -3   3   8  19  15
-8  -3   3   8  19  15
-8  -3   3   8  15  19
```

(b) Give a loop invariant for the main loop in the selection sort algorithm.

In the kth iteration, the first (or last) k items in the list are sorted

7. (2 marks)
Identify whether the pseudocode below describes an algorithm. If it is an algorithm, explain why, otherwise, explain why not.

```
input n
while n is odd
  n = n - 2
output n
```

No as it loops forever

8. (5 marks)
A and **B** are bit lists representing subsets of a single set of items.

Write a Python program that checks whether **A** represents a subset of **B**, printing `True` if it is a subset and `False` otherwise. For a subset of items **X** to be a subset of another **Y**, all items in **X** must be in **Y**.

Assume that the lists **A** and **B** are defined and consist of bits representing subsets.

```
result = True
for i in range(len(A)):
    if A[i] == 1 and B[i] != 1:
        result = False
        break
print(result)
```

9. (4 marks)

Write a Python program which replaces the first two instances of `str1` with `str2` in the string `string` and then prints it. If there is less than two instances of `str1` in `string`, replace all instances. Assume that `str1`, `str2` and `string` are all already defined and that `str1` and `str2` will always be completely distinct.

```
string = string.replace(str1, str2, 2)
print(string)
```