ID 2550814

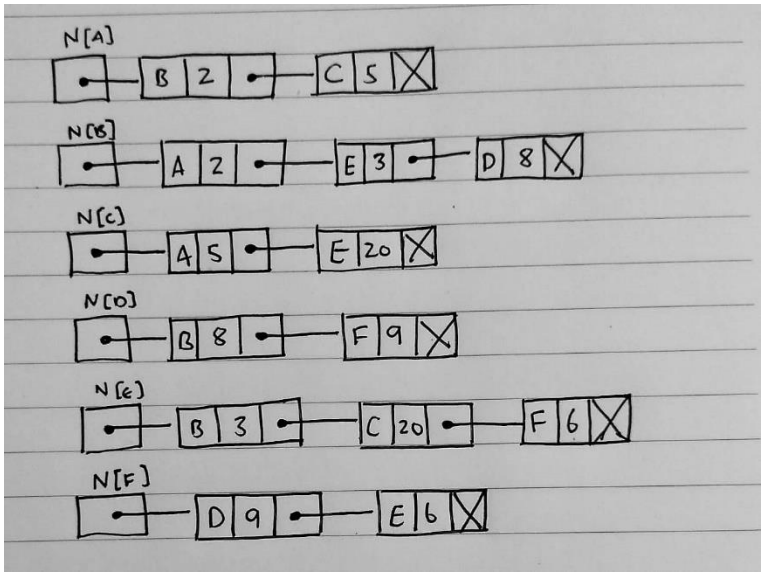
Exam for Data Structures, Algorithms, and Databases

After inserting your student ID and the module name in the title, header and footer, write your answers between here and the statement of good academic conduct. Your ID and the module name will automatically appear on any subsequent pages.

QUESTION 1
PART 1

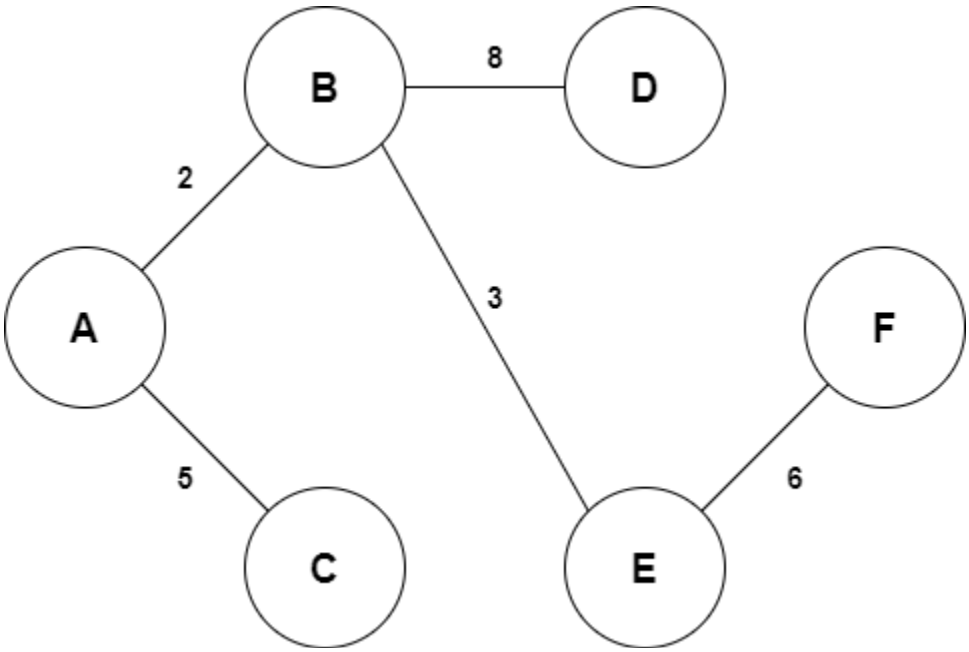
Adjacency List:

N[v]	Neighbours
A	(B, 2) (C, 5)
B	(A, 2) (E, 3) (D, 8)
C	(A, 5) (E, 20)
D	(B, 8) (F, 9)
E	(B, 3) (C, 20)
F	(D, 9) (E, 6)



PART 2

The final MST is given below:



Starting at node A; it is found that node B has the smallest weight connecting it to A, so it is added to the MST. Then node E is added as it has the lowest connecting weight among A and B. Then node C is added to the MST at A as it has the smallest weight among A, B and E. Then node F is connected at E, and finally node D at B.

Total weight = 2+3+5+6+8 = 24

QUESTION 2

A	B	C	D	E	F	FINISHED
0, A	∞, B	∞, C	∞, D	∞, E	∞, F	
0, A ✓	5, A	2, A	∞, D	∞, E	∞, F	A
0, A ✓	5, A	2, A ✓	4, C	12, C	∞, F	C
0, A ✓	5, A	2, A ✓	4, C ✓	6, D	12, D	D
0, A ✓	5, A ✓	2, A ✓	4, C ✓	6, D	12, D	B
0, A ✓	5, A ✓	2, A ✓	4, C ✓	6, D ✓	11, E	E
0, A ✓	5, A ✓	2, A ✓	4, C ✓	6, D ✓	11, E ✓	F

Shortest path from A to F: A → C → D → E → F
Weight of path from A to F = 11

QUESTION 3

PART 1

Answer: C

PART 2

Answer: B (it is a min-heap)

PART 3

Setting the first element as the pivot:
Move R till it is lesser than P:

```
20  15  5  25  30  10
L                   R
P
```

Move L till it is greater than P:

```
20  15  5  25  30  10
          L       R
P
```

Swap L and R:

```
20  15  5  10  30  25
          L       R
P
```

Move R till it is lesser than P:

```
20  15  5  10  30  25
          L
P         R
```

Swap the element 10 and P as L=R:

10 15 5 20 30 25 [this is the result of the first partition]

```
          P
          L
          R
```

Taking the second sub-array of the first partition after splitting into two at the pivot:
Move R till it is lesser than P, then move L till it is greater than P:

```
30  25
L   R
P
```

Since R is already lesser than P, and there is no element greater than P in the sub-array for L, L&R are swapped:

25 30 [this is the sorted second sub-array]

Taking the first sub-array of the first partition after splitting into two at the pivot:
Move R till it is lesser than P:
10 15 5
L R
P

Move L till it is greater than P:
10 15 5
L R
P

Swap L and R:
10 5 15
L R
P

Move R till it is lesser than P:
10 5 15
L
P R

Swap the element 5 and P as L=R:
5 10 15 [this is the first partition of the first sub-array]
P
L
R

Taking the sub-array of the first partition of the first sub-array:
10 15
L R
P

Move R till it is lesser than P:
10 15
L
R
P

Since L = R = P, the element 10 gets swapped with itself:
10 15 [this is the sorted sub-array of the first sub-array]
Hence, the sorted first sub-array is:
5 10 15

Joining the sorted sub-arrays with the pivot in the first partition:
The final sorted array is:
5 10 15 20 25 30

Do not write below this line

Statement of good academic conduct

By submitting this assignment, I understand that I am agreeing to the following statement of good academic conduct:

- I confirm that this assignment is **my own work** and I have not worked with others in preparing this assignment.
- I confirm this assignment was written by me and is in my own words, except for any materials from published or other sources which are clearly indicated and acknowledged as such by appropriate referencing.
- I confirm that this work is not copied from any other person's work (published or unpublished), web site, book or other source, and has not previously been submitted for assessment either at the University of Birmingham or elsewhere.
- I confirm that I have not asked, or paid, others to prepare any part of this work for me.
- I confirm that I have read and understood the University regulations on plagiarism (https://intranet.birmingham.ac.uk/as/registry/policy/conduct/plagiarism/index.aspx).