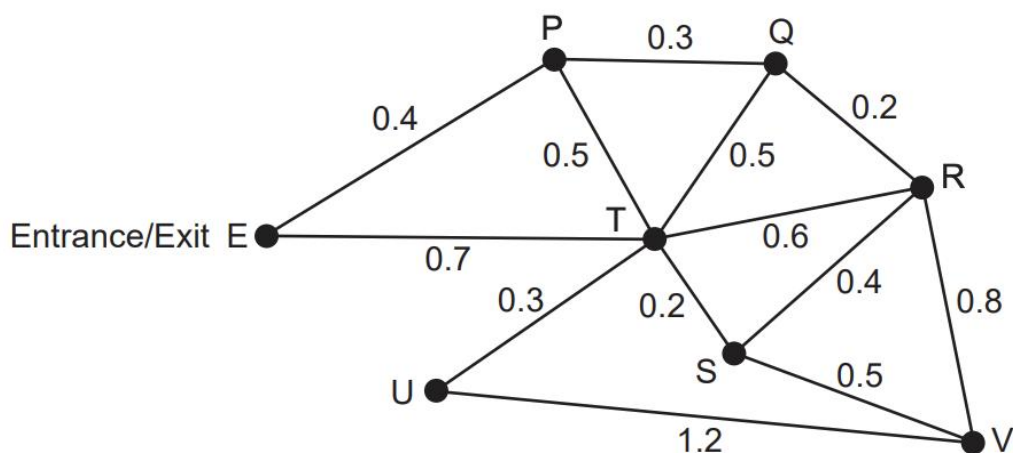


**Question 4****(11 marks)**

A marine park has attractions with paths connecting them. The vertices on the graph represent the attractions and the numbers on the edges represent the path distances (km) between the attractions. Visitors can either walk around the park or take one of the many shuttle buses that run between attractions.



The manager of the marine park leaves his office, which is located at the entrance/exit (E) and walks to attraction V.

- (a) (i) Determine the shortest distance from E to V. (1 mark)
- (ii) If the manager needs to pick up some tools left at U on the way, determine the route he should take and the corresponding distance, given he wants to take the shortest route from E to V. (2 marks)

Rachel arrives at the entrance. She wants to complete a Hamiltonian cycle.

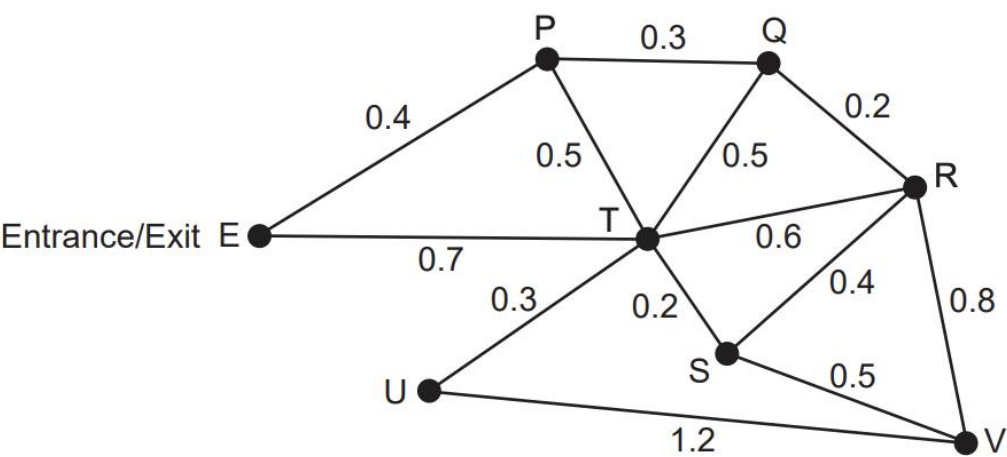
(b) State the route she should take.

(2 marks)

Drinking water is already being supplied at E. The manager has recently received funding to establish drinking fountains at each attraction. For this to happen, pipelines will need to be laid along the paths to each attraction. He has drawn up a table to show the distances between attractions.

	E	P	Q	R	S	T	U	V
E	–	0.4	–	–	–	0.7	–	–
P	0.4	–	0.3	–	–	0.5	–	–
Q	–	0.3	–	0.2	–	0.5	–	–
R	–	–	0.2	–	0.4	0.6	–	0.8
S	–	–	–	0.4	–	0.2	–	0.5
T	0.7	0.5	0.5	0.6	0.2	–	0.3	–
U	–	–	–	–	–	0.3	–	1.2
V	–	–	–	0.8	0.5	–	1.2	–

- (c)
- (i)
- Use Prim’s algorithm, or otherwise, to determine the minimum total length of pipelines. Highlight the required pipelines on the diagram below.
- (4 marks)



- (ii) The manager has been told that a pipeline of length 0.2 km could be laid from S to U. How, if at all, will this affect the total length of pipelines that should be laid in order to maintain a minimum length? (2 marks)