

### Tutorial Sheet 15 (Answers)

1 (a)

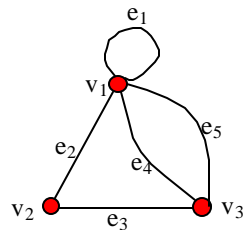
$$A^2 = \begin{pmatrix} 6 & 3 & 3 \\ 3 & 2 & 2 \\ 3 & 2 & 5 \end{pmatrix}$$

$$A^3 = \begin{pmatrix} 15 & 9 & 15 \\ 9 & 5 & 8 \\ 15 & 8 & 8 \end{pmatrix}$$

- (b) # of walk of length 2 from  $v_1$  to  $v_3 = 3$   
 # of walk of length 3 from  $v_1$  to  $v_3 = 15$

(c) Graph G:

Walks:

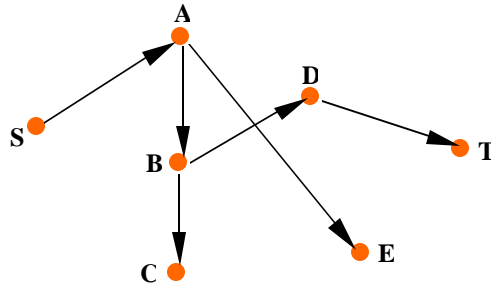


{  $v_3e_4v_1e_4v_3$ ,  $v_3e_5v_1e_5v_3$ ,  $v_3e_4v_1e_5v_3$ ,  $v_3e_5v_1e_4v_3$ ,  $v_3e_3v_2e_3v_3$  }

2. (a) path, no a simple path, not a circuit  
 (b) not a path, not a circuit  
 (c) simple circuit  
 (d) circuit, not a simple circuit  
 (e) closed walk

3.

| Iteration $n$ | Solved Nodes Directly Connected to Unsolved Nodes | Closest Connected Unsolved Node | Total Distance Involved                         | $n$ th Nearest Node | Minimum Distance | Last Connection |
|---------------|---|---------------------------------|---|---------------------|------------------|-----------------|
| 1             | S   | A                               | 7   | A                   | 7                | SA              |
| 2             | A<br>S  | B<br>B                          | $7 + 4 = 11$<br>13                              | B                   | 11               | AB              |
| 3             | A<br>B<br>S                                       | E<br>C<br>C                     | $7 + 10 = 17$<br>$11 + 5 = 16$<br>28            | C                   | 16               | BC              |
| 4,5           | A<br>B<br>C                                       | E<br>D<br>E                     | $7 + 10 = 17$<br>$11 + 6 = 17$<br>$16 + 3 = 19$ | E<br>D              | 17<br>17         | AE<br>BD        |
| 6             | D<br>E  | T<br>T                          | $17 + 5 = 22$<br>$17 + 12 = 29$                 | T                   | 22               | DT              |



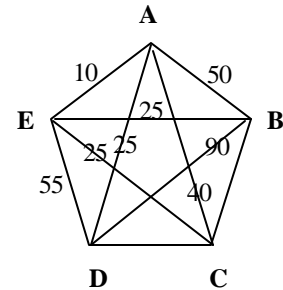
**Conclusion**

Therefore, the shortest path from S to T is SABDT with path length 22.

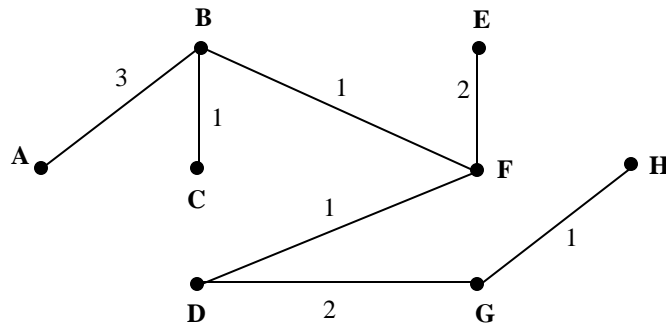
4. The Cheapest routes are as follows.

The graph represents the problem

|          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|
|          | <b>A</b> | <b>B</b> | <b>C</b> | <b>D</b> | <b>E</b> |
| <b>A</b> | -        | 35       | 35       | 25       | 10       |
| <b>B</b> | 35       | -        | 20       | 30       | 25       |
| <b>C</b> | 35       | 20       | -        | 10       | 25       |
| <b>D</b> | 25       | 30       | 10       | -        | 35       |
| <b>E</b> | 10       | 25       | 25       | 35       | -        |



5.



| Center | Earliest time each receives the news |
|--------|--------------------------------------|
| B      | 3:03 p.m.                            |
| C      | 3:04 p.m.                            |
| D      | 3:05 p.m.                            |
| E      | 3:06 p.m.                            |
| F      | 3:04 p.m.                            |
| G      | 3:07 p.m.                            |
| H      | 3:08 p.m.                            |