

**AS Practice paper**

- 1 a** In a bubble sort we compare adjacent items in the list starting at the beginning so we obtain the following table

21	16	11	25	18	15	23	10
16	11	21	18	15	23	10	25
11	16	18	15	21	10	23	25
11	16	15	18	10	21	23	25
11	15	16	10	18	21	23	25
11	15	10	16	18	21	23	25
11	10	15	16	18	21	23	25
10	11	15	16	18	21	23	25
10	11	15	16	18	21	23	25

- b** For a list of  $n$  items:  
 The 1st pass requires  $(n - 1)$  comparisons.  
 The 2nd pass required  $(n - 2)$  comparisons.  
 The process continues until the final pass, which requires 1 comparison.  
 The total number of comparisons is  
 $1 + 2 + 3 + \dots + (n - 2) + (n - 1)$

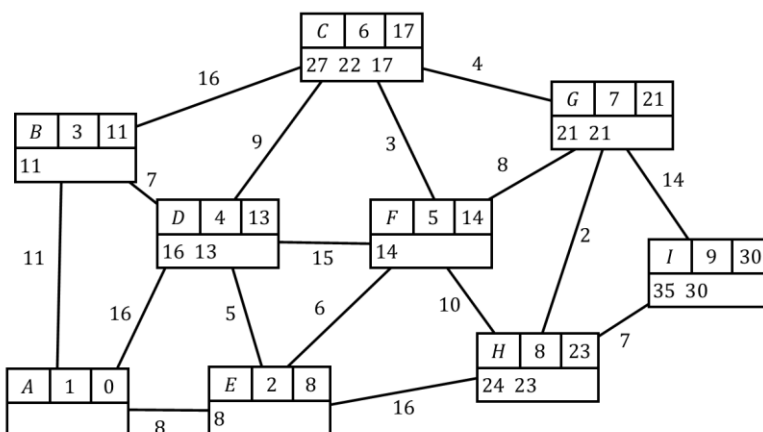
This is an AP with sum  $\frac{n}{2}(n-1) = \frac{n^2}{2} - \frac{n}{2}$

Thus the bubble sort has quadratic order

- c** For large  $n$  we can consider only the quadratic term.  $0.018 \times \left(\frac{1000}{50}\right)^2 = 7.2$  seconds

This is an estimate only because the time taken is not directly proportional to  $n^2$ . This is used as an approximation.

**2 a**



Quickest route: **AEFCGHI**

Time required: 30 minutes

- b** New quickest route: **AEHI** (or **AEFHI**)

Time required: 31 minutes

- 3** Total area =  $20x + 30y$  so  $20x + 30y \leq 1000$   
 $\Rightarrow 2x + 3y \leq 100$   
Total cost =  $40x + 55y$  so  $40x + 55y \geq 1200$   
 $\Rightarrow 8x + 11y \geq 240$   
Total words =  $25x + 60y$  so  $25x + 60y \leq 1600$   
 $\Rightarrow 5x + 12y \leq 320$   
Also  $x \geq 0, y \geq 0$   
and we want to maximise the profit which is  
 $P = 24x + 32y$

- 4 a** We use the route inspection (Chinese postman) algorithm  
Odd nodes  $A, E, F, G$

Pairings:  $AE + FG = 9 + 11 = 20$   
 $AF + EG = 5 + 16 = 21$   
 $AG + EF = 6 + 4 = 10$

The sections that need to be traversed twice are  $AG$  and  $EF$ .

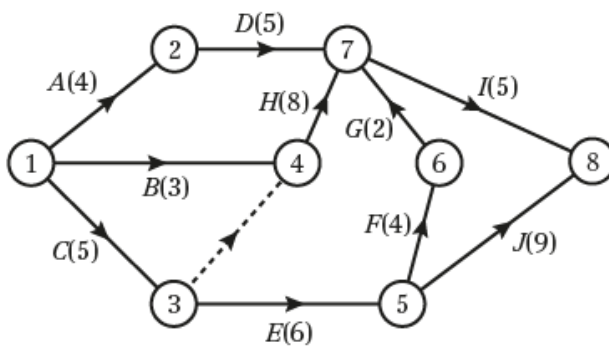
Total time required =  $144 + 10 = 154$  minutes

- b**  $FG = 12$ , Route via  $A = 11$ , this is shorter so repeat  $FA$  and  $AG$

- c** New total time = 158 so length of new tunnel must be  $158 - 144 - FA - AG$   
 $= 158 - 144 - 5 - 6 = 3$

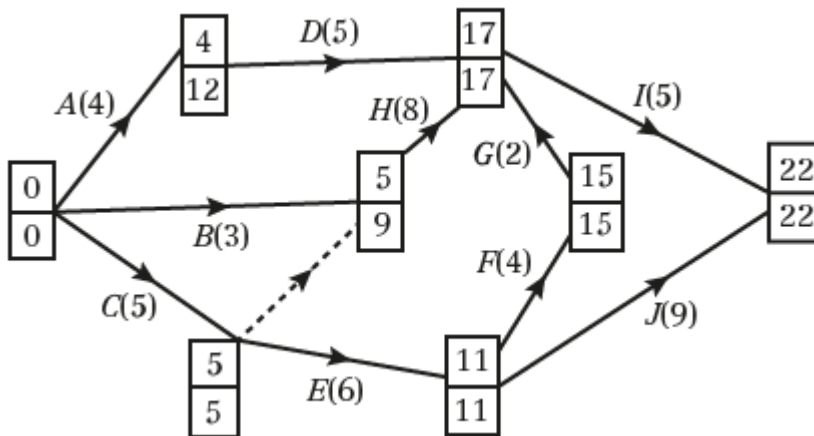
5 a

Activity	Immediately preceding activities
A	–
B	–
C	–
D	A
E	C
F	E
G	F
H	B, C
I	D, G, H
J	E



b The dotted lines represent a dummy activity showing that activity *H* depends on activities *B* and *C* whereas activity *E* depends on activity *C* only.

c



d The critical path is *CEFGI*.

e Total float for activity *D* is  $17 - 5 - 4 = 8$  hours