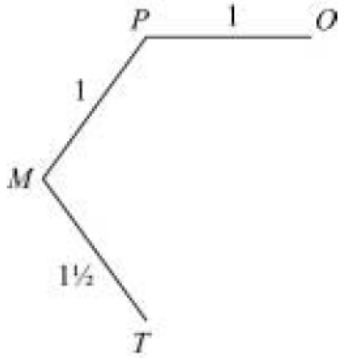
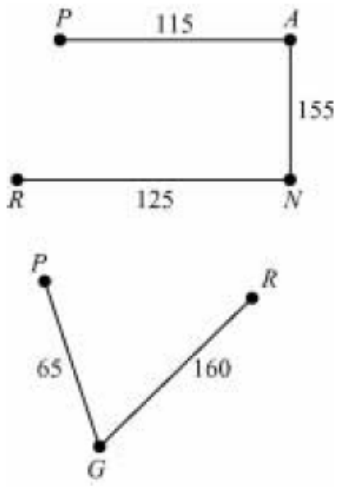
Decision 1 Travelling Salesman Answers

8(a)(i)	$L \overset{35}{-} N \overset{20}{-} O \overset{15}{-} L = 70$	B1	1	
(ii)	$L \overset{35}{-} O \overset{40}{-} N \overset{25}{-} L = 95$	B1	1	
(b)	Any cycle	B1	1	
(c)(i)	$S \overset{20}{-} P \overset{25}{-} O \overset{15}{-} L \overset{35}{-} N \overset{25}{-} R \overset{25}{-} S$	M1		Tour
		M1		Every vertex
		A1	3	All correct
(ii)	Tour	E1		
	May be improved	E1	2	
(iii)	$S \overset{30}{-} R \overset{17}{-} O \overset{15}{-} L \overset{35}{-} N \overset{21}{-} P \overset{20}{-} S$	M1		Tour to every vertex with $SR + N + P$
		A1		All correct
	$= 138$	B1	3	
	Total		**11**	

5(a)(i)	7	B1	1	
(ii)	7	B1	1	
(b)(i)	Missing values			
	(PF 3) any 2 values correct	B1		
	$\left(\text{OT } 3\frac{1}{4}\right)$ other 2 values correct	B1	2	
(ii)	FTPOMF			
	$=8\frac{1}{4}$ ISW	B1	1	
(iii)	FTMPOF	M1		Tour
		M1		Visits all vertices
		A1		Correct order
	$=7$	B1	4	
(iv)	Delete F			
		M1 A1 A1		MST – letters or numbers 3 edges Correct
	Add $1\frac{1}{4}+2$	m1		Adding 2 edges from F
	$=6\frac{3}{4}$	A1	5	SC $6\frac{3}{4}$ with no working $2/5$
	Total		**14**	

3(a)	*A* *B* *C* *D* *A* 8 13 17 26 = 64	M1 A1	 2	4 numbers (either part)
(b)	*A* *D* *C* *B* *A* 11 18 9 14 = 52	 A1	 1	
(c)	*A* *C* *B* *D* *A* 6 9 25 26 = 66} **Alternative if matrix used:** M1 3 numbers } all different rows M1 4th number } and columns A1 correct numbers B1 66	M1 M1 A1 B1	 4	Tour Visits every vertex Correct order
(d)	52 (their lowest of (a), (b), (c))	B1F	1	Allow " part (b) "
	Total		**8**	

6(a)(i)	$G \to P \to A \to N \to R \to G$ 65 115 155 125 160	M1 M1 A1		Tour Visits all places Correct order
	Total = 620	B1	4	
(ii)		M1		SCA (MST + extra edge(s))
		m1		MST
		A1		
		m1		2 edges from G
	$LB = 395 + 225 = 620$	A1	5	
(iii)	$T = 620$	E1F		Their (a)(ii) $\leq T \leq$ their (a)(i) where (a)(i) $\geq$ (a)(ii)
(b)(i)	92	B1	1	
(ii)	87	B1	1	
(iii)	6	B1	1	
(iv)	$n!$	B1	1	
	Total		**14**	