

Exercise 3C

1 a Arcs in order

- AF (9)
 - FB (14)
 - AC (20)
 - AE (25)
 - DE (26)
- Weight = $9 + 14 + 20 + 25 + 26$
 $= 94$

	↓1	↓3	↓4	↓6	↓5	↓2
	A	B	C	D	E	F
A	-	15	20	34	25	9
B	15	-	36	38	28	(14)
C	(20)	36	-	43	38	22
D	34	38	43	-	(26)	40
E	(25)	28	38	26	-	31
F	(9)	14	22	40	31	-

b Arcs in order

- RS (28)
 - ST (16)
 - SU (19)
 - UV (37)
- Weight = $28 + 16 + 19 + 37$
 $= 100$

	↓1	↓2	↓3	↓4	↓5
	R	S	T	U	V
R	-	28	30	31	41
S	(28)	-	16	19	43
T	30	(16)	-	22	41
U	31	(19)	22	-	37
V	41	43	41	(37)	-

2

	Birmingham	Nottingham	Lincoln	Stoke	Manchester
Birmingham	-	262.4	160	78.4	140.8
Nottingham	262.4	-	59.2	89.6	118.4
Lincoln	160	59.2	-	144	137.6
Stoke	78.4	89.6	144	-	70.4
Manchester	140.8	118.4	137.6	70.4	-

Start at Birmingham

	1	4	5	2	3
	Birmingham	Nottingham	Lincoln	Stoke	Manchester
Birmingham	-	262.4	160	78.4	140.8
Nottingham	262.4	-	59.2	(89.6)	118.4
Lincoln	160	(59.2)	-	144	137.6
Stoke	(78.4)	89.6	144	-	70.4
Manchester	140.8	118.4	137.6	(70.4)	-

- The first arc is Birmingham Stoke (78.4 km).
- The second arc is Stoke Manchester (70.4 km).
- The third arc is Stoke Nottingham (89.6 km).
- The fourth arc is Nottingham Lincoln (59.2 km).
- The minimum total length of the transit system is 297.6 km.

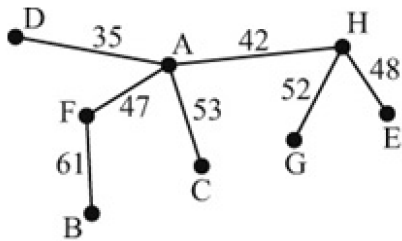
3 a Arcs in order

- DA (35)
- AH (42)
- AF (47)
- HE (48)
- HG (52)
- AC (53)
- FB (61)

Weight = 338
 \therefore cost = 3×338
 = €1014

	↓2	↓8	↓7	↓1	↓5	↓4	↓6	↓3
	A	B	C	D	E	F	G	H
A	-	84	53	(35)	-	47	-	42
B	84	-	71	113	142	(61)	75	-
C	(53)	71	-	-	-	-	59	-
D	35	113	-	-	58	67	151	-
E	-	142	-	58	-	168	159	(48)
F	(47)	61	-	67	168	-	-	73
G	-	75	59	151	159	-	-	(52)
H	(42)	-	-	-	48	73	52	-

b



- c i It is cheaper to translate from E to H then from H to G at a cost of $48 + 52 = 100$ euro rather than 159 euro per 1000 words.
- ii A direct translation is likely to be more accurate than a translation via another language.

4 a

	1	5	7	9	8	2	6	3	4	10
	X	A	B	C	D	E	F	G	H	I
X	—	65	80	89	74	26	71	41	41	74
A	65	—	27	41	22	37	20	29	(25)	43
B	80	27	—	30	24	55	(16)	46	40	42
C	89	41	30	—	50	84	(24)	70	49	26
D	(74)	(22)	24	50	—	51	35	34	47	63
E	(26)	37	55	84	51	—	52	18	23	68
F	71	(20)	16	24	35	52	—	45	31	27
G	41	29	46	70	34	(18)	45	—	25	64
H	41	25	40	49	47	(23)	31	25	—	44
I	74	43	42	(26)	63	68	27	64	44	—

The first arc is XE (26 km).
 The second arc is EG (18 km).
 The third arc is EH (23 km).
 The fourth arc is HA (25 km).
 The fifth arc is AF (20 km).
 The sixth arc is FB (16 km).
 The seventh arc is AD (22 km).
 The eighth arc is FC (24 km).
 The ninth arc is CI (26 km).
 The minimum spanning tree is $26 + 18 + 23 + 25 + 20 + 16 + 22 + 24 + 26 = 200$ km

b

	2	1	5	6	2	8	2	9	7	10
	<i>X</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>
<i>X</i>	—	65	80	89	74	26	71	41	41	74
<i>A</i>	65	—	27	41	22	37	20	29	25	43
<i>B</i>	80	27	—	30	24	55	16	46	40	42
<i>C</i>	89	41	30	—	50	84	24	70	49	26
<i>D</i>	74	22	24	50	—	51	35	34	47	63
<i>E</i>	26	37	55	84	51	—	52	18	23	68
<i>F</i>	71	20	16	24	35	52	—	45	31	27
<i>G</i>	41	29	46	70	34	18	45	—	25	64
<i>H</i>	41	25	40	49	47	23	31	25	—	44
<i>I</i>	74	43	42	26	63	68	27	64	44	—

XD (74km) and XF (71km) must be added in first to satisfy given property.

Now start Prim's from A . The third arc is AF (20 km). (Note: now X and D are also part of the tree.)

The fourth arc is FB (16 km).

The fifth arc is FC (24 km).

The sixth arc is AH (25 km).

The seventh arc is HE (23 km).

The eighth arc is EG (18 km).

The ninth arc is CI (26 km).

The minimum spanning tree is $74 + 71 + 20 + 16 + 24 + 25 + 23 + 18 + 26 = 297$ km.

c

	1	3	5	6	2	8	4	9	7	10
	<i>X</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>
<i>X</i>	—	65	80	89	74	26	71	41	41	74
<i>A</i>	65	—	27	41	22	37	20	29	25	43
<i>B</i>	80	27	—	30	24	55	16	46	40	42
<i>C</i>	89	41	30	—	50	84	24	70	49	26
<i>D</i>	74	22	24	50	—	51	35	34	47	63
<i>E</i>	26	37	55	84	51	—	52	18	23	68
<i>F</i>	71	20	16	24	35	52	—	45	31	27
<i>G</i>	41	29	46	70	34	18	45	—	25	64
<i>H</i>	41	25	40	49	47	23	31	25	—	44
<i>I</i>	74	43	42	26	63	68	27	64	44	—

The first arc XD is (74 km).

The second arc is DA (22 km).

The third arc is AF (20 km).

The fourth arc is FB (16 km).

The fifth arc is FC (24 km).

The sixth arc is AH (25 km).

The seventh arc is HE (23 km).

The eighth arc is EG (18 km).

The ninth arc is CI (26 km).

The minimum spanning tree is $74 + 22 + 20 + 16 + 24 + 25 + 23 + 18 + 26 = 248$ km