

# Solution

## Q1

	x	y	d	FG	BOM	f	r	w	TC
NF	95	20		124					2,589.87
1	30	20	65	40		40	0.20	8.00	520.00
2	5	50	120	38		38	0.20	7.60	912.00
3	15	50	110	20		20	0.20	4.00	440.00
4	95	70	50	26		26	0.20	5.20	260.00
5	95	20	0	A	2	248	0.15	37.20	0.00
6	85	45	35	B	0.55	68.2	0.05	3.41	119.35
7	70	10	35	C	1	124	0.03	3.72	130.20
8	85	70	60	D	0.35	43.4	0.08	3.47	208.32
Sum W in =									47.80
Sum W out =									24.80

## Q2

(a)	dd	mm	ss	x (deg)	x (rad)	dd	mm	ss	y (deg)	y (rad)	d(rad)	d (mi)	f	r	w	TC		
NF				-85.0347	-1.48414				38.84325	0.677943						40,372.92		
Detroit	83	6	8	W	-83.1022	-1.45041	42	22	59	N	42.38306	0.739724	0.066871	264.4528	48	1.00	48.00	12,693.73
Gainesville	82	20	11	W	-82.3364	-1.43704	29	40	27	N	29.67417	0.517912	0.164673	651.4159	24	1.00	24.00	15,633.98
Memphis	90	0	25	W	-90.0069	-1.57092	35	6	20	N	35.10556	0.612708	0.095166	376.4127	32	1.00	32.00	12,045.21
(b)	Louisville, KY																	
(c)				x (deg)	x (rad)	dd	mm	ss	y (deg)	y (rad)	d(rad)	d (mi)	f	r	w	TC		
Louisville, KY																95,568.00		
Detroit												362	48	2	96.00	34,752.00		
Gainesville												755	24	2	48.00	36,240.00		
Memphis												384	32	2	64.00	24,576.00		
(d)				x (deg)	x (rad)	dd	mm	ss	y (deg)	y (rad)	d(rad)	d (mi)	f	r	w	TC		
Cary, NC																138,464.00		
Detroit												680	48	2	96.00	65,280.00		
Gainesville												530	24	2	48.00	25,440.00		
Memphis												746	32	2	64.00	47,744.00		
Increase =																42,896.00		

### Q3(a)

Site	y	X	1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	5	6	7	8	9	10	11	12	13
1 b	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
2 b	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 b	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4 b	1	4	0	1	1	1	0	0	0	1	1	0	0	0	0	-1	0	0	-1	-1	0	0	0	-1	-1	-1	-1	-1
5 b	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6 b	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 b	1	7	1	0	0	0	0	1	1	1	0	0	0	0	0	0	-1	-1	-1	0	0	0	-1	-1	-1	-1	-1	-1
8 b	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9 b	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10 b	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 b	1	11	0	0	0	0	0	0	0	0	0	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0
12 b	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 b	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum	4	Sum	1	1	1	1	1	1	1	1	1	1	1	1	1													
p =	4																											
TC =	min 71572																											

C	1	2	3	4	5	6	7	8	9	10	11	12	13
1	0	8557	15415	18303	11704	14670	19104	23735	20877	17209	66915	34458	25047
2	25218	0	8941	9059	10884	12286	15790	17295	14817	14860	59317	31476	23982
3	55845	10990	0	12333	26009	16967	27242	16609	12150	16532	59622	32674	26519
4	45199	7591	8407	0	14729	9189	13446	10433	9127	11483	49167	26861	21257
5	23567	7436	14456	12010	0	8651	7976	17365	16180	12827	55490	28835	20985
6	57438	16321	18337	14569	16821	0	8084	11313	12624	6572	39406	20721	15159
7	40361	11319	15886	11503	8368	4362	0	13759	13899	9716	47503	24805	18051
8	76793	18987	14833	13670	27903	9349	21071	0	3571	7123	33638	19836	17342
9	80209	19315	12885	14200	30871	12387	25275	4240	0	9536	37298	22082	19618
10	92562	27119	24544	25011	34264	9029	24736	11841	13350	0	22351	12403	10336
11	137363	41315	33783	40870	56569	20660	46157	21342	19929	8530	0	4887	9866
12	144080	44657	37712	45481	59876	22129	49094	25635	24033	9642	9955	0	6724
13	136566	44367	39912	46933	56823	21111	46588	29224	27842	10478	26206	8768	0
Pop	56.9261	19.3152	15.7132	23.0516	28.2703	14.5391	26.9452	17.5942	14.8172	10.5837	27.7311	13.6142	10.4404

Objective Cell: \$B\$19  maximise  minimise  target value: 0

Variable Cells: \$B\$3:\$B\$15,\$E\$3:\$Q\$15

Constraints:

- <Add new constraint>
- \$B\$16 = \$B\$17
- \$S\$3:\$AE\$15 <= 0
- \$E\$16:\$Q\$16 = 1
- \$B\$3:\$B\$15 bin
- \$E\$3:\$Q\$15 <= 1

=

Add constraint Cancel

Delete selected constraint

Make unconstrained variable cells non-negative  
 Show named ranges in constraint list

### Q3(b)

Find the row in C with the smallest sum