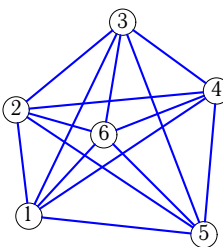


Алгоритм отжига

Найти длину гамильтонова цикла S_4 в полном графе K_6 после четырех циклов решения задачи методом отжига. Даны расстояния $L_{i,j}$ между вершинами. Даны также: начальная последовательность вершин L_0 , последовательность замен вершин \mathbf{Z} и выпавшие при этом вероятности перехода \mathbf{P}_k , $k = 1, \dots, 4$. Переход на худшее ($\Delta S_k = S_k - S_{k-1} > 0$) решение допустим, если $P_* = 100e^{-\Delta S_k/T_k} > P_k$, где снижение температуры происходит по закону $T_{k+1} = 0.5T_k$ от $T_1 = 100$.

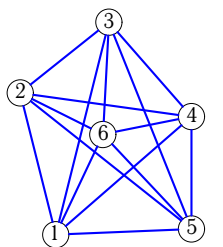
Задача 13.1.



Ребро	$L_{i,j}$
1-2	20
1-3	40
1-4	42
1-5	33
1-6	21
2-3	26
2-4	38
2-5	42
2-6	17
3-4	22
3-5	43
3-6	21
4-5	27
4-6	22
5-6	26

$\mathbf{V} = [1, 4, 5, 2, 6, 3, 1]$.
 $\mathbf{Z} = [V_3 \rightleftharpoons V_4], [V_4 \rightleftharpoons V_6],$
 $[V_5 \rightleftharpoons V_2], [V_6 \rightleftharpoons V_2]$.
 $\mathbf{P} = 49, 54, 43, 54.$

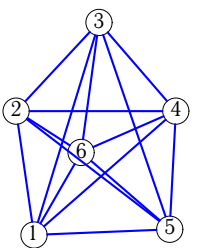
Задача 13.2.



Ребро	$L_{i,j}$
1-2	27
1-3	41
1-4	34
1-5	25
1-6	21
2-3	21
2-4	32
2-5	41
2-6	17
3-4	23
3-5	42
3-6	21
4-5	21
4-6	17
5-6	24

$\mathbf{V} = [1, 3, 5, 4, 2, 6, 1]$.
 $\mathbf{Z} = [V_3 \rightleftharpoons V_4], [V_4 \rightleftharpoons V_6],$
 $[V_5 \rightleftharpoons V_6], [V_6 \rightleftharpoons V_2]$.
 $\mathbf{P} = 57, 43, 46, 32.$

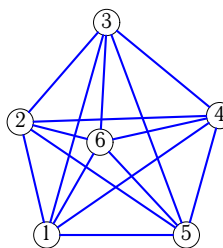
Задача 13.3.



Ребро	$L_{i,j}$
1-2	23
1-3	42
1-4	35
1-5	25
1-6	18
2-3	23
2-4	30
2-5	36
2-6	14
3-4	22
3-5	41
3-6	24
4-5	22
4-6	19
5-6	22

$\mathbf{V} = [1, 4, 5, 6, 2, 3, 1]$.
 $\mathbf{Z} = [V_4 \rightleftharpoons V_5], [V_2 \rightleftharpoons V_4],$
 $[V_5 \rightleftharpoons V_2], [V_6 \rightleftharpoons V_2]$.
 $\mathbf{P} = 34, 81, 26, 74.$

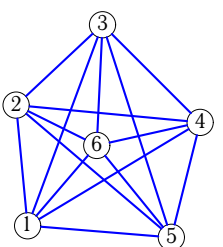
Задача 13.4.



Ребро	$L_{i,j}$
1-2	22
1-3	41
1-4	39
1-5	26
1-6	20
2-3	25
2-4	37
2-5	38
2-6	15
3-4	27
3-5	42
3-6	22
4-5	23
4-6	23
5-6	24

$\mathbf{V} = [1, 4, 2, 3, 5, 6, 1]$.
 $\mathbf{Z} = [V_3 \rightleftharpoons V_4], [V_4 \rightleftharpoons V_6],$
 $[V_5 \rightleftharpoons V_2], [V_6 \rightleftharpoons V_2]$.
 $\mathbf{P} = 97, 83, 74, 86.$

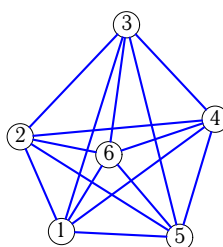
Задача 13.5.



Ребро	$L_{i,j}$
1-2	23
1-3	40
1-4	38
1-5	27
1-6	20
2-3	22
2-4	34
2-5	38
2-6	17
3-4	26
3-5	42
3-6	22
4-5	22
4-6	20
5-6	22

$\mathbf{V} = [1, 3, 5, 4, 6, 2, 1]$.
 $\mathbf{Z} = [V_4 \rightleftharpoons V_6], [V_5 \rightleftharpoons V_6],$
 $[V_3 \rightleftharpoons V_4], [V_2 \rightleftharpoons V_3]$.
 $\mathbf{P} = 88, 25, 88, 29.$

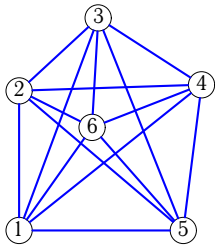
Задача 13.6.



Ребро	$L_{i,j}$
1-2	19
1-3	41
1-4	36
1-5	22
1-6	17
2-3	29
2-4	37
2-5	35
2-6	17
3-4	24
3-5	41
3-6	24
4-5	23
4-6	21
5-6	20

$\mathbf{V} = [1, 5, 2, 4, 3, 6, 1]$.
 $\mathbf{Z} = [V_4 \rightleftharpoons V_6], [V_5 \rightleftharpoons V_2],$
 $[V_6 \rightleftharpoons V_2], [V_2 \rightleftharpoons V_3]$.
 $\mathbf{P} = 91, 34, 32, 17.$

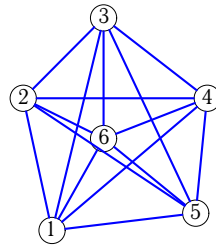
Задача 13.7.



$V = [1, 2, 3, 4, 5, 6, 1].$
 $Z = [V_3 \rightleftharpoons V_4], [V_4 \rightleftharpoons V_6],$
 $[V_5 \rightleftharpoons V_6], [V_6 \rightleftharpoons V_2].$
 $P = 90, 45, 43, 31.$

Ребро	$L_{i,j}$
1-2	26
1-3	42
1-4	44
1-5	31
1-6	24
2-3	20
2-4	34
2-5	40
2-6	15
3-4	23
3-5	43
3-6	20
4-5	27
4-6	22
5-6	26

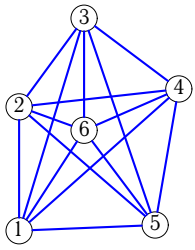
Задача 13.8.



$V = [1, 3, 5, 4, 6, 2, 1].$
 $Z = [V_3 \rightleftharpoons V_4], [V_4 \rightleftharpoons V_6],$
 $[V_5 \rightleftharpoons V_6], [V_2 \rightleftharpoons V_4].$
 $P = 41, 60, 85, 60.$

Ребро	$L_{i,j}$
1-2	25
1-3	41
1-4	38
1-5	27
1-6	20
2-3	21
2-4	34
2-5	39
2-6	17
3-4	24
3-5	40
3-6	22
4-5	21
4-6	21
5-6	22

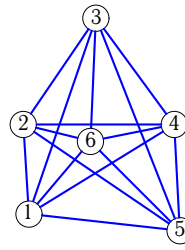
Задача 13.9.



$V = [1, 3, 4, 5, 6, 2, 1].$
 $Z = [V_4 \rightleftharpoons V_5], [V_5 \rightleftharpoons V_6],$
 $[V_2 \rightleftharpoons V_4], [V_6 \rightleftharpoons V_2].$
 $P = 78, 24, 63, 17.$

Ребро	$L_{i,j}$
1-2	23
1-3	42
1-4	40
1-5	25
1-6	22
2-3	20
2-4	30
2-5	34
2-6	13
3-4	22
3-5	41
3-6	21
4-5	26
4-6	19
5-6	22

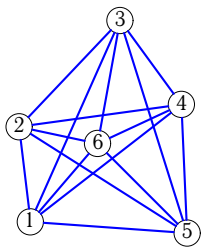
Задача 13.10.



$V = [1, 5, 2, 6, 3, 4, 1].$
 $Z = [V_3 \rightleftharpoons V_4], [V_4 \rightleftharpoons V_5],$
 $[V_5 \rightleftharpoons V_2], [V_6 \rightleftharpoons V_2].$
 $P = 78, 79, 25, 82.$

Ребро	$L_{i,j}$
1-2	17
1-3	39
1-4	32
1-5	28
1-6	18
2-3	24
2-4	28
2-5	35
2-6	13
3-4	25
3-5	43
3-6	23
4-5	20
4-6	16
5-6	24

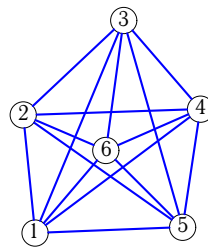
Задача 13.11.



$V = [1, 3, 4, 5, 6, 2, 1].$
 $Z = [V_2 \rightleftharpoons V_4], [V_3 \rightleftharpoons V_4],$
 $[V_4 \rightleftharpoons V_6], [V_5 \rightleftharpoons V_6].$
 $P = 63, 49, 45, 53.$

Ребро	$L_{i,j}$
1-2	18
1-3	41
1-4	36
1-5	29
1-6	19
2-3	27
2-4	31
2-5	37
2-6	15
3-4	19
3-5	42
3-6	23
4-5	24
4-6	17
5-6	24

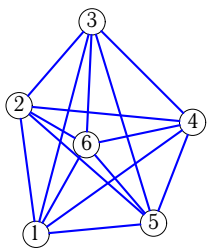
Задача 13.12.



$V = [1, 3, 4, 5, 6, 2, 1].$
 $Z = [V_2 \rightleftharpoons V_4], [V_4 \rightleftharpoons V_6],$
 $[V_3 \rightleftharpoons V_5], [V_5 \rightleftharpoons V_2].$
 $P = 51, 23, 29, 31.$

Ребро	$L_{i,j}$
1-2	22
1-3	43
1-4	39
1-5	28
1-6	20
2-3	26
2-4	33
2-5	36
2-6	17
3-4	22
3-5	40
3-6	24
4-5	22
4-6	19
5-6	20

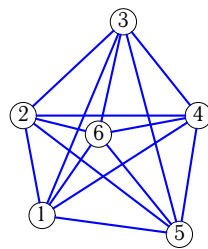
Задача 13.13.



$V = [1, 3, 4, 5, 6, 2, 1].$
 $Z = [V_3 \rightleftharpoons V_4], [V_4 \rightleftharpoons V_6],$
 $[V_5 \rightleftharpoons V_2], [V_6 \rightleftharpoons V_2].$
 $P = 33, 82, 51, 76.$

Ребро	$L_{i,j}$
1-2	24
1-3	41
1-4	36
1-5	22
1-6	19
2-3	21
2-4	33
2-5	33
2-6	14
3-4	27
3-5	39
3-6	23
4-5	20
4-6	20
5-6	19

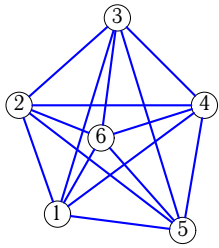
Задача 13.14.



$V = [1, 4, 2, 3, 5, 6, 1].$
 $Z = [V_5 \rightleftharpoons V_2], [V_4 \rightleftharpoons V_5],$
 $[V_2 \rightleftharpoons V_3], [V_3 \rightleftharpoons V_4].$
 $P = 88, 54, 24, 64.$

Ребро	$L_{i,j}$
1-2	19
1-3	39
1-4	35
1-5	26
1-6	18
2-3	26
2-4	33
2-5	37
2-6	14
3-4	22
3-5	41
3-6	21
4-5	22
4-6	19
5-6	24

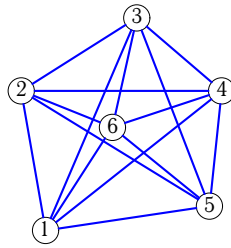
Задача 13.15.



$V = [1, 4, 3, 5, 6, 2, 1].$
 $Z = [V_4 \rightleftharpoons V_5], [V_3 \rightleftharpoons V_5],$
 $[V_5 \rightleftharpoons V_6], [V_2 \rightleftharpoons V_3].$
 $P = 89, 22, 92, 13.$

Ребро	$L_{i,j}$
1-2	21
1-3	38
1-4	34
1-5	24
1-6	16
2-3	24
2-4	35
2-5	39
2-6	16
3-4	23
3-5	42
3-6	23
4-5	24
4-6	20
5-6	23

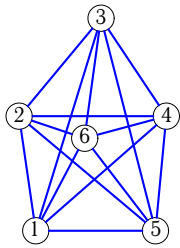
Задача 13.16.



$V = [1, 3, 4, 5, 6, 2, 1].$
 $Z = [V_3 \rightleftharpoons V_5], [V_4 \rightleftharpoons V_6],$
 $[V_5 \rightleftharpoons V_6], [V_2 \rightleftharpoons V_3].$
 $P = 92, 53, 75, 56.$

Ребро	$L_{i,j}$
1-2	26
1-3	43
1-4	42
1-5	31
1-6	23
2-3	25
2-4	37
2-5	41
2-6	18
3-4	21
3-5	38
3-6	21
4-5	22
4-6	21
5-6	23

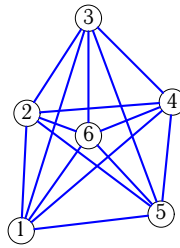
Задача 13.17.



$V = [1, 2, 3, 4, 5, 6, 1].$
 $Z = [V_4 \rightleftharpoons V_6], [V_5 \rightleftharpoons V_6],$
 $[V_2 \rightleftharpoons V_3], [V_3 \rightleftharpoons V_4].$
 $P = 56, 29, 56, 27.$

Ребро	$L_{i,j}$
1-2	22
1-3	42
1-4	32
1-5	22
1-6	19
2-3	24
2-4	27
2-5	33
2-6	13
3-4	22
3-5	41
3-6	23
4-5	21
4-6	16
5-6	22

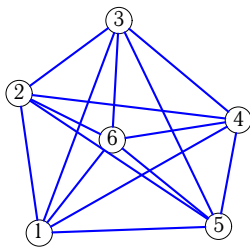
Задача 13.18.



$V = [1, 2, 4, 3, 5, 6, 1].$
 $Z = [V_5 \rightleftharpoons V_6], [V_3 \rightleftharpoons V_4],$
 $[V_4 \rightleftharpoons V_6], [V_6 \rightleftharpoons V_2].$
 $P = 78, 84, 62, 84.$

Ребро	$L_{i,j}$
1-2	22
1-3	42
1-4	37
1-5	26
1-6	22
2-3	21
2-4	27
2-5	31
2-6	12
3-4	22
3-5	39
3-6	22
4-5	21
4-6	17
5-6	20

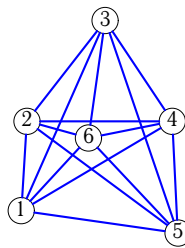
Задача 13.19.



$V = [1, 4, 5, 3, 6, 2, 1].$
 $Z = [V_2 \rightleftharpoons V_3], [V_3 \rightleftharpoons V_4],$
 $[V_4 \rightleftharpoons V_6], [V_5 \rightleftharpoons V_2].$
 $P = 77, 93, 27, 106.$

Ребро	$L_{i,j}$
1-2	26
1-3	42
1-4	43
1-5	34
1-6	22
2-3	23
2-4	41
2-5	45
2-6	19
3-4	29
3-5	43
3-6	22
4-5	20
4-6	24
5-6	26

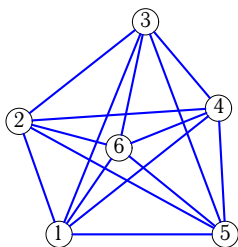
Задача 13.20.



$V = [1, 4, 3, 5, 2, 6, 1].$
 $Z = [V_3 \rightleftharpoons V_4], [V_2 \rightleftharpoons V_3],$
 $[V_4 \rightleftharpoons V_6], [V_5 \rightleftharpoons V_6].$
 $P = 30, 93, 81, 93.$

Ребро	$L_{i,j}$
1-2	17
1-3	39
1-4	33
1-5	30
1-6	18
2-3	24
2-4	27
2-5	35
2-6	12
3-4	23
3-5	42
3-6	22
4-5	21
4-6	16
5-6	24

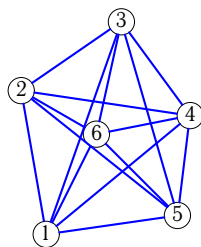
Задача 13.21.



$V = [1, 4, 3, 5, 6, 2, 1].$
 $Z = [V_4 \rightleftharpoons V_5], [V_2 \rightleftharpoons V_4],$
 $[V_5 \rightleftharpoons V_2], [V_6 \rightleftharpoons V_2].$
 $P = 34, 98, 21, 100.$

Ребро	$L_{i,j}$
1-2	22
1-3	43
1-4	38
1-5	31
1-6	20
2-3	30
2-4	37
2-5	44
2-6	19
3-4	21
3-5	42
3-6	24
4-5	24
4-6	20
5-6	26

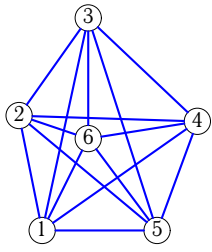
Задача 13.22.



$V = [1, 4, 5, 3, 2, 6, 1].$
 $Z = [V_5 \rightleftharpoons V_6], [V_2 \rightleftharpoons V_3],$
 $[V_3 \rightleftharpoons V_4], [V_4 \rightleftharpoons V_5].$
 $P = 54, 98, 46, 101.$

Ребро	$L_{i,j}$
1-2	27
1-3	42
1-4	35
1-5	25
1-6	21
2-3	23
2-4	32
2-5	37
2-6	16
3-4	22
3-5	38
3-6	21
4-5	19
4-6	18
5-6	21

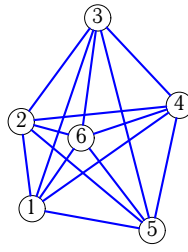
Задача 13.23.



$V = [1, 4, 3, 5, 6, 2, 1].$
 $Z = [V_4 \rightleftharpoons V_6], [V_5 \rightleftharpoons V_2],$
 $[V_6 \rightleftharpoons V_2], [V_2 \rightleftharpoons V_3].$
 $P = 68, 51, 50, 42.$

Ребро	$L_{i,j}$
1-2	22
1-3	41
1-4	35
1-5	21
1-6	19
2-3	22
2-4	33
2-5	34
2-6	13
3-4	28
3-5	42
3-6	22
4-5	22
4-6	21
5-6	21

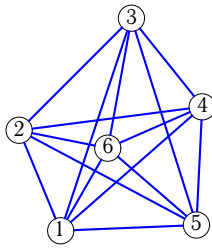
Задача 13.24.



$V = [1, 4, 3, 5, 6, 2, 1].$
 $Z = [V_4 \rightleftharpoons V_6], [V_5 \rightleftharpoons V_6],$
 $[V_3 \rightleftharpoons V_5], [V_6 \rightleftharpoons V_2].$
 $P = 47, 40, 58, 40.$

Ребро	$L_{i,j}$
1-2	16
1-3	38
1-4	34
1-5	23
1-6	16
2-3	24
2-4	30
2-5	32
2-6	11
3-4	22
3-5	41
3-6	23
4-5	24
4-6	19
5-6	22

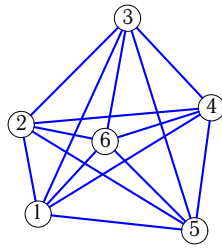
Задача 13.25.



$V = [1, 4, 2, 5, 6, 3, 1].$
 $Z = [V_3 \rightleftharpoons V_5], [V_4 \rightleftharpoons V_6],$
 $[V_5 \rightleftharpoons V_2], [V_6 \rightleftharpoons V_2].$
 $P = 51, 36, 21, 31.$

Ребро	$L_{i,j}$
1-2	20
1-3	42
1-4	35
1-5	25
1-6	18
2-3	30
2-4	34
2-5	38
2-6	17
3-4	21
3-5	41
3-6	25
4-5	22
4-6	19
5-6	22

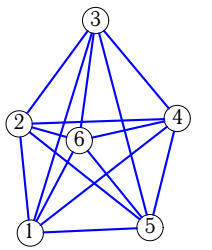
Задача 13.26.



$V = [1, 4, 2, 5, 6, 3, 1].$
 $Z = [V_3 \rightleftharpoons V_4], [V_4 \rightleftharpoons V_5],$
 $[V_5 \rightleftharpoons V_6], [V_2 \rightleftharpoons V_3].$
 $P = 22, 43, 55, 53.$

Ребро	$L_{i,j}$
1-2	17
1-3	40
1-4	38
1-5	29
1-6	18
2-3	28
2-4	36
2-5	38
2-6	16
3-4	23
3-5	42
3-6	23
4-5	23
4-6	21
5-6	24

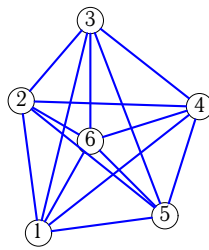
Задача 13.27.



$V = [1, 2, 3, 4, 5, 6, 1].$
 $Z = [V_3 \rightleftharpoons V_4], [V_2 \rightleftharpoons V_4],$
 $[V_5 \rightleftharpoons V_6], [V_4 \rightleftharpoons V_5].$
 $P = 25, 66, 49, 66.$

Ребро	$L_{i,j}$
1-2	20
1-3	42
1-4	35
1-5	22
1-6	19
2-3	24
2-4	30
2-5	31
2-6	11
3-4	24
3-5	40
3-6	23
4-5	21
4-6	19
5-6	21

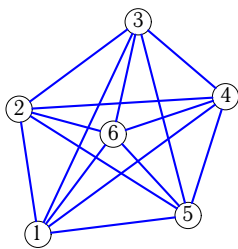
Задача 13.28.



$V = [1, 3, 4, 5, 6, 2, 1].$
 $Z = [V_3 \rightleftharpoons V_5], [V_4 \rightleftharpoons V_6],$
 $[V_5 \rightleftharpoons V_6], [V_6 \rightleftharpoons V_2].$
 $P = 59, 59, 46, 65.$

Ребро	$L_{i,j}$
1-2	25
1-3	41
1-4	38
1-5	24
1-6	20
2-3	20
2-4	33
2-5	34
2-6	15
3-4	26
3-5	39
3-6	22
4-5	21
4-6	21
5-6	20

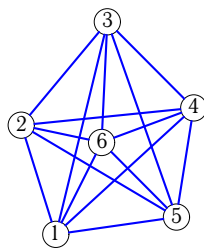
Задача 13.29.



$V = [1, 3, 4, 5, 6, 2, 1].$
 $Z = [V_3 \rightleftharpoons V_4], [V_2 \rightleftharpoons V_4],$
 $[V_5 \rightleftharpoons V_6], [V_4 \rightleftharpoons V_5].$
 $P = 57, 34, 81, 20.$

Ребро	$L_{i,j}$
1-2	24
1-3	44
1-4	44
1-5	28
1-6	23
2-3	28
2-4	39
2-5	37
2-6	18
3-4	21
3-5	37
3-6	21
4-5	23
4-6	22
5-6	21

Задача 13.30.



$V = [1, 4, 3, 5, 6, 2, 1].$
 $Z = [V_5 \rightleftharpoons V_2], [V_4 \rightleftharpoons V_6],$
 $[V_6 \rightleftharpoons V_2], [V_2 \rightleftharpoons V_4].$
 $P = 76, 82, 52, 95.$

Ребро	$L_{i,j}$
1-2	21
1-3	41
1-4	35
1-5	23
1-6	19
2-3	25
2-4	32
2-5	34
2-6	15
3-4	23
3-5	39
3-6	22
4-5	21
4-6	18
5-6	20

Алгоритм отжига

№	0	1	2	3	4	5
1	189	209	186	146	166	146
2	174	164	164	173	183	183
3	158	173	166	157	167	157
4	187	173	172	172	141	141
5	164	195	175	163	181	163
6	159	158	166	192	179	179
7	146	176	163	146	176	146
8	165	150	165	180	154	154
9	148	162	155	142	128	128
10	156	146	159	162	178	162
11	141	128	140	166	155	140
12	146	135	167	163	194	163
13	145	158	183	130	146	130
14	177	148	157	139	154	139
15	159	163	149	159	136	136
16	153	172	173	188	160	160
17	130	144	128	138	148	148
18	152	139	128	156	138	128
19	173	150	175	178	217	178
20	163	150	128	142	125	125
21	168	175	155	155	150	150
22	152	156	130	146	161	146
23	161	140	139	158	152	139
24	146	136	150	153	150	150
25	196	186	172	130	147	130
26	199	178	169	153	141	141
27	129	154	167	150	149	149
28	148	162	156	171	188	171
29	151	168	167	173	161	161
30	153	154	142	156	143	143