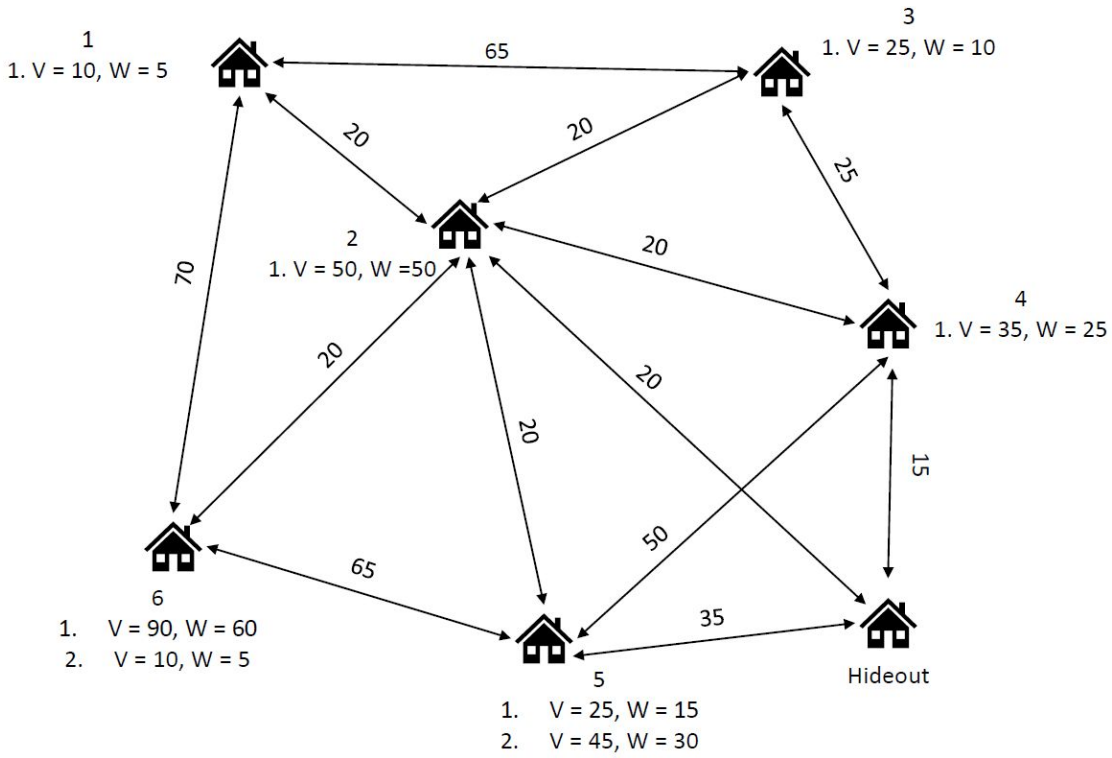
Assignment 12 Traveling Thief Problem



mat_{dist} 15<20<25<35<50<65<70

Loc	H	1	2	3	4	5	6
H	0	---	20	---	15	35	---
1	---	0	20	65	---	---	70
2	20	20	0	20	20	20	20
3	---	65	20	0	25	---	---
4	15	---	20	25	0	50	---
5	35	---	20	---	50	0	65
6	---	70	20	---	---	65	0

Problem Formulation:

The above is a bi-objective optimization problem. Let ‘f’ denote the objective.

The cost function (g): $\min(f_1(t))$ and $\max(f_2(q))$
Where t = time for operation execution and q = profit (total weight of items(kg))

Search space, S = locations: 1,2,3,4,5,6 = Solution space, G

Decoding function (d): t = V*distance (updation of path in G)

Modelling:
Encoding technique: Gray encoding
Neighbourhood function: Standard deterministic 1-bit neighbourhood (Flip one bit)

Reasoning:

Initially, we start from Hideout (H) then looking at the mat_{dist} we determine which location yield the minimum distance. So select 4, (eta: 8.75 min) (profit: 25kg).

Next from 4, we can explore 5, 2 or 3 if we check mat_{dist} we observe 2 has the least distance. But we can visit it later since 2 is a junction point. So we move to the north and visit 3 (eta: 14.58 min) (profit: 10kg).

Further from 3, we can reach to 1 and 2 but the distance to 1 is more compared to 2 so we choose 2 (eta: 16.67 min) (profit: 50kg).

Now we have reached the junction point where it is equidistant to all other locations. (Note: we could have already taken 2 first from H but this would not gain profit).

From 2 we have two choices either to 1(north) or 6 (south) if we look at the distance both take equal time to reach the destination. Instead, we look at the two configurations of 6 out of which the second one has exactly the same as at 1. So, it would be better to move towards the south (6) otherwise could increase the time taken to reach the H.

Reaching at 6 we have two configurations 1.(V=90, W=60) & 2.(V=10, W=5) where the former could cost us 97.5 min and the latter could fetch us only 10.83 min so we proceed with this (profit: 5kg).

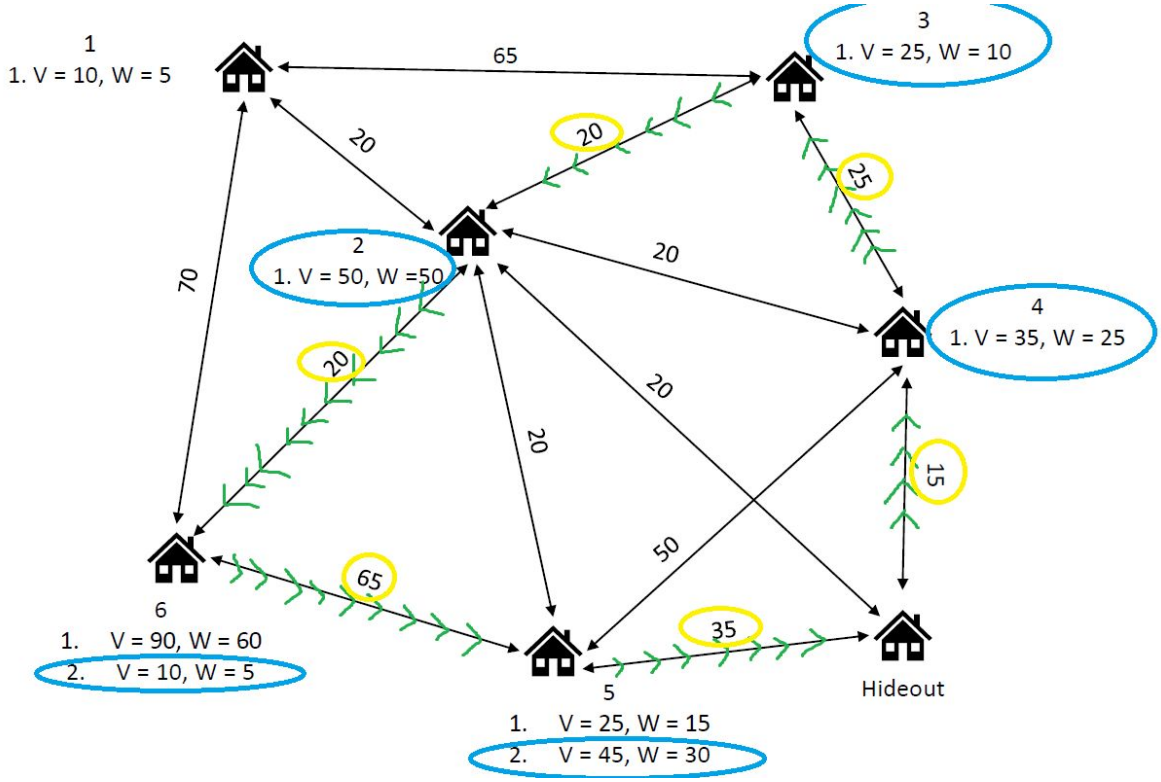
So we have just arrived at 5 which is neighbour to our H. Again we observe we have two configurations 1.(V=25, W=15) & 2.(V=45, W=30). Since we have compensated for 60 kg we take the second option (profit: 30kg). So we have just saved a lot of time by reducing the chances of getting caught!

Finally, we head towards our H (eta: 26.25 min) with all the profits collected so far.

At the hideout, all gather with a profit of **120 kg** within **1.28 hrs**.
(team speed: 0.4 units)

Note: Gray encoding enables to flip one bit which can easily shift our neighbourhood although mat_{dist} provided with the minimum distance we take some decisions based for maximizing our profit too. Regarding objectives we achieved slightly more than half of the maximum weight out of 200 kg by limiting our time to less than almost to 1 hr 30 mins which is fair even though the time limit was not mentioned.

Sketch map:


1
1. V = 10, W = 5
65
3
1. V = 25, W = 10
20
20
25
2
1. V = 50, W =50
20
70
4
1. V = 35, W = 25
20
20
20
15
50
65
35
6
1. V = 90, W = 60
2. V = 10, W = 5
5
1. V = 25, W = 15
2. V = 45, W = 30
Hideout