Assignment3
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Exercise 2

1.

By draw.io

2.
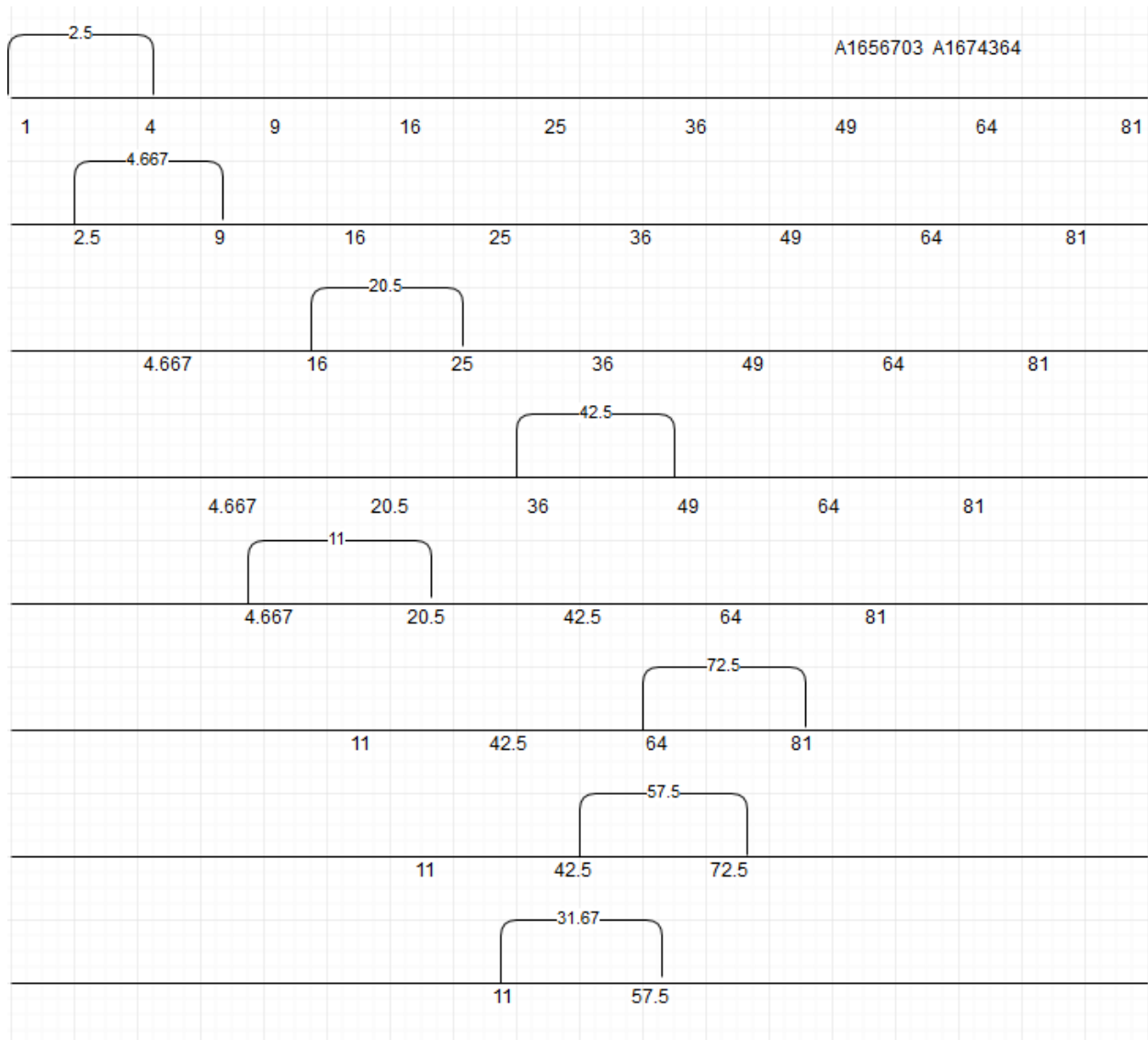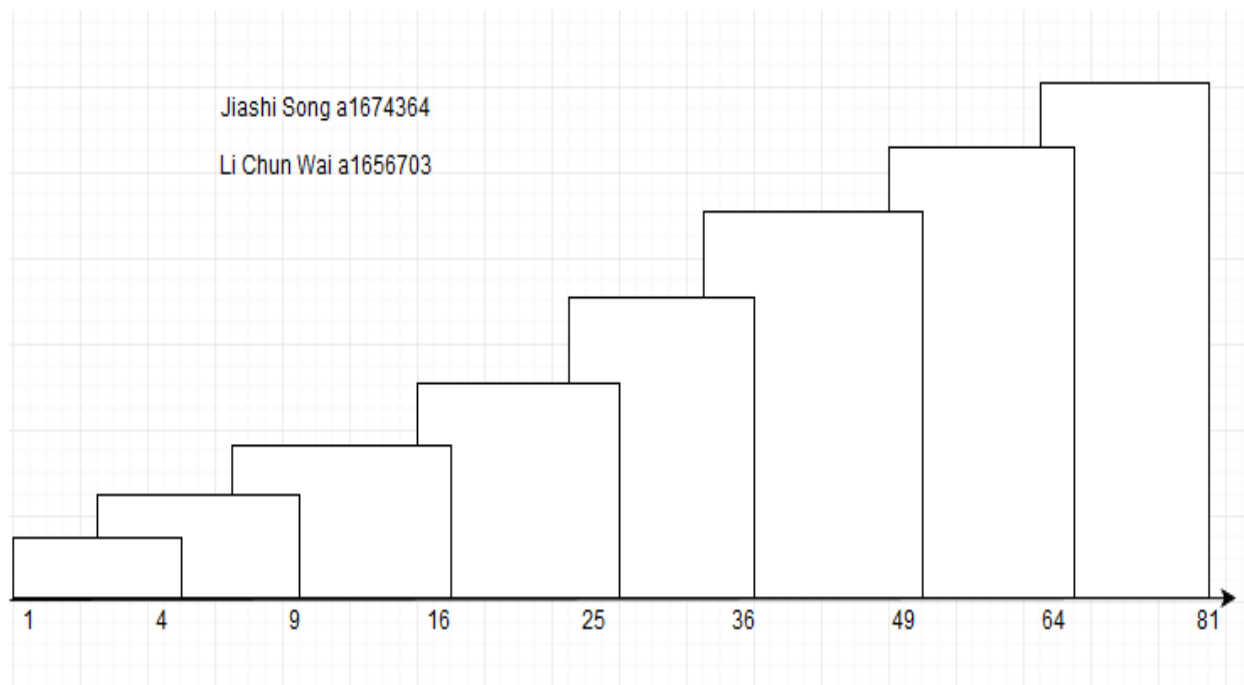

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Exercise 3

1.

According to the question, we knew each advertisers have same budget so that A, B and C would be selected by same probability on greedy algorithm.

If greedy algorithm want to assign at least 4 of the 6queries xxyyzz.

We knew, xx can be selected by A, B and C; yy can be selected by B and C; zz can be selected by C only.

Case 1:

In the first two allocations, xx will be selected by A. In the second two allocations, yy will be selected by B . In the last two allocations ,zz will be selected by C.

<div align="center">
XXYYZZ
AABBCC
</div>

Case 2 :

In the first two allocations, xx will be selected by A . In the second two allocations, yy will be selected by C . So that there is no space for B

<div align="center">
XXYZZ

AACC
</div>

Case 3 :

In the first two allocations, xx will be selected by B . In the second two allocations, yy will be selected by C . So that there is no space for A.

<div align="center">
XXYYZZ

BBCC
</div>

Case 4 :

In the first two allocations, xx will be selected by C . In the second two allocations, yy will be selected by B . So that there is no space for A.

<div align="center">
XXYYZZ

CCBB
</div>

So the greedy algorithm will assign at least 4 of the 6 queries xxyyzz

2.

We knew the optimal offline algorithm will assign 6 queries. And greedy algorithm as an online algorithm will assign at least 4 queries. We calculate the half of the optimal offline algorithm is 3.

If we only can get two X Y & Z {

If greedy algorithm assign A to xx, a rest of queries will be selected by B and C

or C only. Optimal offline algorithm is AABBCC. Greedy algorithm is AABBCC or

AACC

If greedy algorithm assign B to xx, a rest of queries will be selected by C

only. Optimal offline algorithm is AABBCC. Greedy algorithm is BBCC

If greedy algorithm assign C to xx, A and B cannot be

assigned Optimal offline algorithm is AABBCC. Greedy

algorithm is CC }

So in order to make a sequence which can assign as few as half the queries of the optimal offline algorithm. We have to change the sequence of queries to 4.
Note : In this case we may left budget

New sequence is yyzz ; Optimal offline algorithm is BBCC ; greedy algorithm is CC.

However ,If sequence is 6 the greedy algorithm can assign as half as the queries that the optimal algorithm . There is a way :

XXZZZZ and YYZZZZ

Note : In this case number of Z must have more than 2