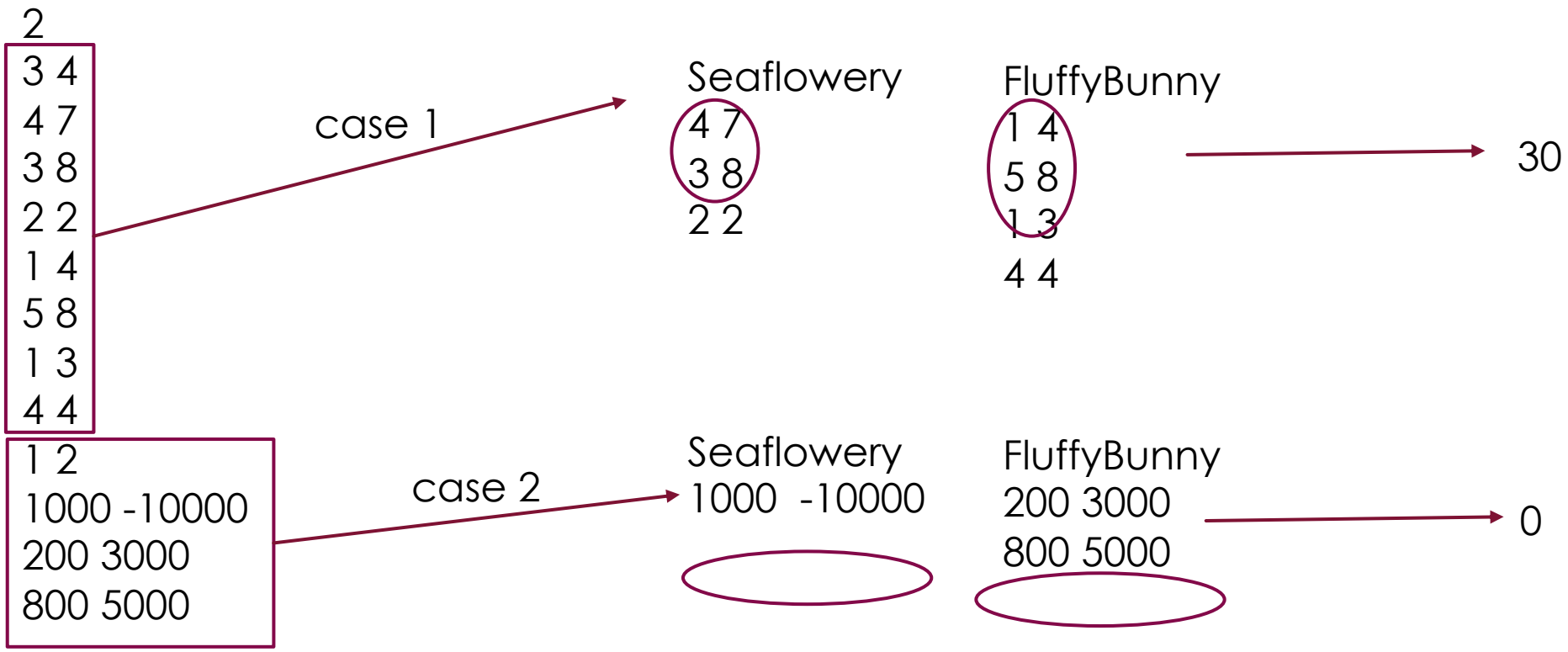
Lab12 Solution

YAO ZHAO

Lab12.A: FU

- Seaflowery and FluffyBunny are rewriting the lyrics in a song. Seaflowery has prepared N words while FluffyBunny has prepared M words which they can choose from. Each word has a length l_i and elegance e_i. The two girls wants the total length of their words to be the same. Under such circumstance, they would like the sum of elegance of their chosen words to be maximized. Please tell them the maximum sum of elegance.
- Note that either girl can choose no word at all.

Sample Input



Sample Output

30
0

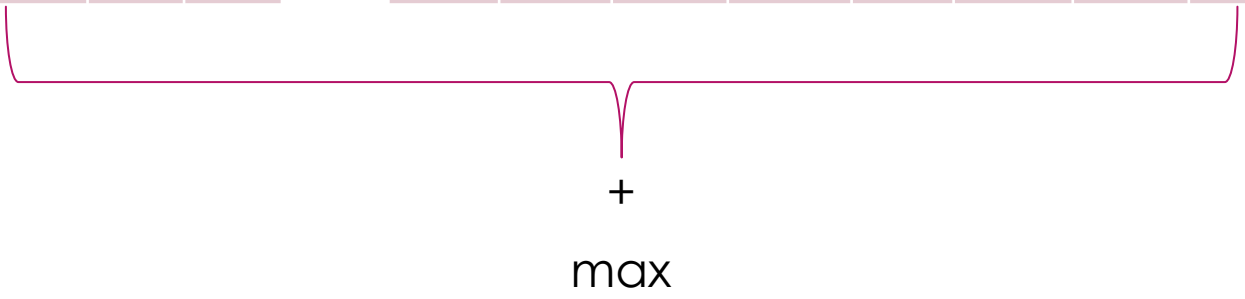
Obviously, it is a Knapsack problem.

Seaflowery:

	0	1	2	3	4	5	6	7	8	9
final	0	-∞	2	8	-∞	10	-∞	15	-∞	17

FluffyBunny:

	0	1	2	3	4	5	6	7	8	9
final	0	4	7	-∞	4	8	11	15	-∞	12



\+

max

But……

$$1 \leq N, M \leq 1000, 1 \leq l_i \leq 1000$$

Time Complexity: 1000*(1000*1000)=1,000,000,000

too huge

$$maximize \sum_{i=1}^{N+M} e_i x_i$$

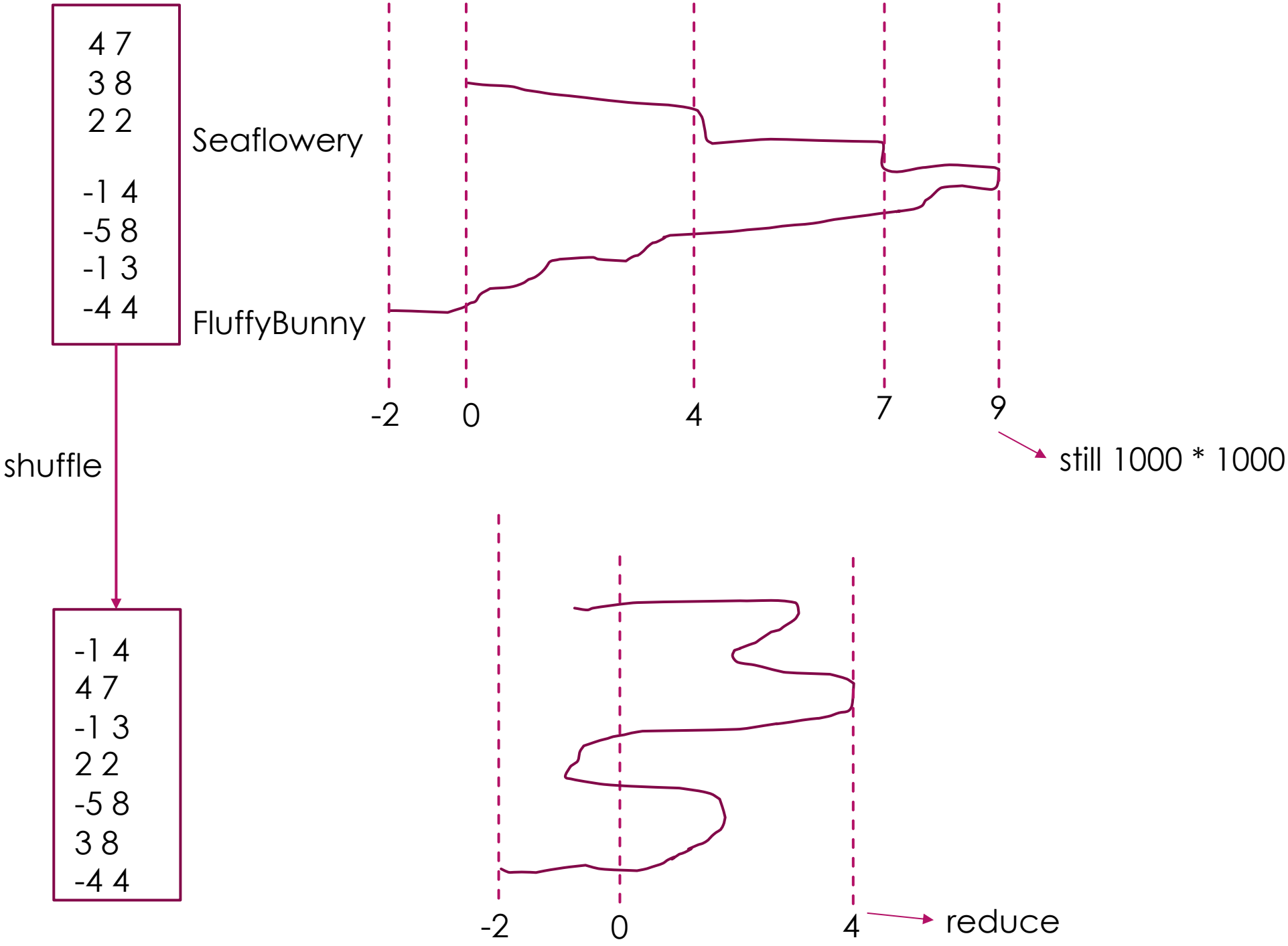
$$subject\ to\ \sum_{i=1}^{N} l_i x_i = \sum_{i=N+1}^{N+M} l_i x_i \quad x_i \in \{0,1\}$$

$$\sum_{i=1}^{N} l_i x_i = \sum_{i=N+1}^{N+M} l_i x_i \quad x_i \in \{0,1\}$$

$$\sum_{i=1}^{N} l_i x_i - \sum_{i=N+1}^{N+M} l_i x_i = 0 \quad x_i \in \{0,1\}$$

$$let\ l_i = -l_i \quad if\ N+1 \le i \le N+M$$

$$\sum_{i=1}^{N+M} l_i x_i = 0$$


4 7
3 8
2 2
-1 4
-5 8
-1 3
-4 4
Seaflowery
FluffyBunny
-2
0
4
7
9
still 1000 * 1000
shuffle
-1 4
4 7
-1 3
2 2
-5 8
3 8
-4 4
-2
0
4
reduce

-1 4
4 7
-1 3
2 2
-5 8
3 8
-4 4

-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
-∞	-∞	-∞	-∞	-∞	-∞	-∞	0	-∞	-∞	-∞	-∞	-∞	-∞	-∞

-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
-∞	-∞	-∞	-∞	-∞	-∞	4	0	-∞	-∞	-∞	-∞	-∞	-∞	-∞

-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
-∞	-∞	-∞	-∞	-∞	-∞	4	0	-∞	-∞	11	7	-∞	-∞	-∞

-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
-∞	-∞	-∞	-∞	-∞	7	4	0	-∞	14	11	7	-∞	-∞	-∞

-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
-∞	-∞	-∞	-∞	-∞	7	4	9	6	14	11	16	13	9	-∞

-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
15	12	17	14	22	19	24	21	17	14	11	16	13	9	-∞

-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
15	12	17	23	22	25	24	30	27	32	29	25	22	19	24

-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
26	29	26	34	31	36	33	30	27	32	29	25	22	19	24

So, after shuffle, don't need to set w from -1000*1000 ~ 1000*1000
Actual, you can try the range.

Lab12.B: Happy Bussing

- Seems like some happy-bussing software has been updated so that the checkpoints are now randomly generated (a checkpoint is a point in 3D space).
- However, **little Z** found out that the generator is not that random. It actually picks checkpoints from a huge fixed point lists, so that it appears to be randomly generated.
- As we all know, one has to get to 2 checkpoints to make the record valid. **little Z** has a hacking program that controls the generation of checkpoints. He wants to know the closest pair of checkpoints so that he can finish bussing as fast as possible. Note that the distance is defined as the **Euclid Distance**.
- **little Z** finds that the point list is greater than usually. So he decides to use some random algorithm to solve this problem.

Sample Input

```
7
0 6 2
14 5 5
13 0 13
0 16 4
7 16 3
13 11 4
13 17 15
```

Getting the minimum distance among the given set of points

Note: use some random algorithm

Sample Output

38

按照随机序列 $p_1, p_2, \cdots, p_n$ 处理点

用 δ 表示至今发现的最小距离

初始化 $\delta = d(p_1, p_2)$

为了保存边长 $\delta/2$ 的子正方形，调用 MakeDictionary

For $i = 3, \cdots n$

  确定包含 p_i 的子正方形 S_{ij}

  查找靠近 p_i 的 125 个子正方形

  计算从 p_i 到在这些子正方形中找到的每一个点的距离

  If 有一个点 $p_j (j<i)$ 使得 $\delta' = d(p_j, p_i) < \delta$ then

    删除当前的字典

    为了保存边长 $\delta'/2$ 的子正方形，调用 MakeDictionary

    For 每一个点 $p_1, p_2, \cdots, p_i$：

      确定包含它的边长 $\delta'/2$ 的子正方形

      把这个子正方形插入新字典

    Endfor

  Else

    把 p_i 插入当前的字典

  Endif

Endfor