Course: Algorithm
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Homework: Lab 5

1. **Question 1 –** This question goal is to understand inversions
   a. *Bubble Sort*

Iteration	Inversions	# inversions
0	(34,8); (34,32); (34,21); (64,51); (64,32); (64,21); (51,32); (51,21); (32,21)	9
1	(34,32); (34,21); (51,32); (51,21); (32,21)	5
2	(34,32); (34, 21); (32,21)	3
3	(32, 21)	1
4		0
5		0
Total		**18**

   b. *Selection Sort – select minimum index and swap to the first index*

Iteration	Inversions	# inversions
0	(34,8); (34,32); (34,21); (64,51); (64,32); (64,21); (51,32); (51,21); (32,21)	9
1	(34,32); (34,21); (64,51); (64,32); (64,21); (51,32); (51,21); (32,21)	8
2	(64,51); (64, 32); (64,34); (51,32); (51,34)	5
3	(51, 34); (64, 34)	2
4	(64, 51)	1
5		0
Total		**25**

   c. *Insertion Sort*

Iteration	Inversions	# inversions
0	(34,8); (34,32); (34,21); (64,51); (64,32); (64,21); (51,32); (51,21); (32,21)	9
1	(34,32); (34,21); (64,51); (64,32); (64,21); (51,32); (51,21); (32,21)	8
2	(34,32); (34,21); (64,51); (64,32); (64,21); (51,32); (51,21); (32,21)	8
3	(34,32); (34,21); (51,32); (51,21); (64,32); (64,21); (32,21)	7
4	(32, 21); (34, 21); (51,21); (64, 21)	4

5					0
Total					**36**

2. **Question 2 –** Understand amortized cost analysis

Item #	Operation	Cost for us	Customer paid	Profit	Balance
1	Add	We assume we start with 1 slot. We add 1 item at the cost of 1	7	6	6
2	Add	3 to resize (We have two slots) 1 to add	7	6	3 9
3	Add	6 to resize (We have 4 slots) 1 to add	7	6	3 9
4	Add	1 to add	7	6	15
5	Add	12 to resize (We have 8 slots) 1 to add	7	6	3 9
6	Add	1 to add	7	6	15
7	Add	1 to add	7	6	21
8	Add	1 to add	7	6	27
9	Add	24 to resize (We have 16 slots) 1 to add	7	6	3 9
10	Add	1 to add	7	6	15
11	Add	1 to add	7	6	21
12	Add	1 to add	7	6	27
13	Add	1 to add	7	6	33
14	Add	1 to add	7	6	39
15	Add	1 to add	7	6	45
16	Add	1 to add	7	6	51
17	Add	48 to resize (We have 32 slots) 1 to add	7	6	3 9
18	Add	1 to add	7	6	15

The table above shows the minimum value of "Balance" is **9**