Exercise 1

First example:

Without indexes:

```
1  explain analyze select sum(id) from customer
```

Data Output | Explain | Messages | Notifications

	QUERY PLAN text
1	Aggregate (cost=2854.29..2854.30 rows=1 width=8) (actual time=41.224..41.224 rows=1 loops=1)
2	[...] -> Index Only Scan using customer_pkey on customer (cost=0.29..2604.29 rows=100000 width=4) (actual time=1.102..14.587 rows=100000 loops=1)
3	[...] Heap Fetches: 0
4	Planning Time: 0.966 ms
5	Execution Time: 41.261 ms

With b_tree id index:

Query Editor | Query History

```
1  explain analyze select sum(id) from customer
```

Data Output | Explain | Messages | Notifications

	QUERY PLAN text
1	Aggregate (cost=2854.29..2854.30 rows=1 width=8) (actual time=19.441..19.442 rows=1 loops=1)
2	[...] -> Index Only Scan using id_b_tree on customer (cost=0.29..2604.29 rows=100000 width=4) (actual time=0.803..13.845 rows=100000 loops=1)
3	[...] Heap Fetches: 0
4	Planning Time: 1.336 ms
5	Execution Time: 19.482 ms

With hash index:

```
1  explain analyze select sum(id) from customer
```

Data Output | Explain | Messages | Notifications

	QUERY PLAN text
1	Aggregate (cost=2854.29..2854.30 rows=1 width=8) (actual time=16.039..16.039 rows=1 loops=1)
2	[...] -> Index Only Scan using customer_pkey on customer (cost=0.29..2604.29 rows=100000 width=4) (actual time=0.556..10.093 rows=100000 loops=1)
3	[...] Heap Fetches: 0
4	Planning Time: 1.860 ms
5	Execution Time: 16.091 ms

Therefore,

The cost the same for each case.

Second example:

```
1  explain analyze select id from customer where id = 2 or id = 82
```

Data Output | Explain | Messages | Notifications

	QUERY PLAN text
1	Bitmap Heap Scan on customer (cost=8.60..16.47 rows=2 width=4) (actual time=0.143..0.151 rows=2 loops=1)
2	[...] Recheck Cond: ((id = 2) OR (id = 82))
3	[...] Heap Blocks: exact=2
4	[...] -> BitmapOr (cost=8.60..8.60 rows=2 width=0) (actual time=0.128..0.129 rows=0 loops=1)
5	[...] -> Bitmap Index Scan on customer_pkey (cost=0.00..4.30 rows=1 width=0) (actual time=0.016..0.016 rows=1 loops=1)
6	[...] Index Cond: (id = 2)
7	[...] -> Bitmap Index Scan on customer_pkey (cost=0.00..4.30 rows=1 width=0) (actual time=0.110..0.110 rows=1 loops=1)
8	[...] Index Cond: (id = 82)
9	Planning Time: 0.153 ms
10	Execution Time: 0.230 ms

With b_tree id index:

Query Editor | Query History

```
1  explain analyze select id from customer where id = 2 or id = 82
```

Data Output | Explain | Messages | Notifications

	QUERY PLAN text
1	Bitmap Heap Scan on customer (cost=8.60..16.47 rows=2 width=4) (actual time=0.032..0.035 rows=2 loops=1)
2	[...] Recheck Cond: ((id = 2) OR (id = 82))
3	[...] Heap Blocks: exact=2
4	[...] -> BitmapOr (cost=8.60..8.60 rows=2 width=0) (actual time=0.026..0.027 rows=0 loops=1)
5	[...] -> Bitmap Index Scan on id_b_tree (cost=0.00..4.30 rows=1 width=0) (actual time=0.019..0.019 rows=1 loops=1)
6	[...] Index Cond: (id = 2)
7	[...] -> Bitmap Index Scan on id_b_tree (cost=0.00..4.30 rows=1 width=0) (actual time=0.006..0.006 rows=1 loops=1)
8	[...] Index Cond: (id = 82)
9	Planning Time: 1.509 ms
10	Execution Time: 0.078 ms

With hash index:

Query Editor | Query History

```
1  explain analyze select id from customer where id = 2 or id = 82
```

Data Output | Explain | Messages | Notifications

	QUERY PLAN text
1	Bitmap Heap Scan on customer (cost=8.02..15.89 rows=2 width=4) (actual time=0.069..0.072 rows=2 loops=1)
2	[...] Recheck Cond: ((id = 2) OR (id = 82))
3	[...] Heap Blocks: exact=2
4	[...] -> BitmapOr (cost=8.02..8.02 rows=2 width=0) (actual time=0.062..0.062 rows=0 loops=1)
5	[...] -> Bitmap Index Scan on id_b_tree (cost=0.00..4.01 rows=1 width=0) (actual time=0.046..0.046 rows=1 loops=1)
6	[...] Index Cond: (id = 2)
7	[...] -> Bitmap Index Scan on id_b_tree (cost=0.00..4.01 rows=1 width=0) (actual time=0.015..0.015 rows=1 loops=1)
8	[...] Index Cond: (id = 82)
9	Planning Time: 1.580 ms
10	Execution Time: 0.125 ms

Therefore,

The cost with hash index less then without any index and with b_tree index

Third example:

```
1  explain analyze select id from customer where address in ('Kazan')
```

Data Output | Explain | Messages | Notifications

	QUERY PLAN text
1	Seq Scan on customer (cost=0.00..4192.00 rows=1 width=4) (actual time=25.504..25.504 rows=0 loops=1)
2	[...] Filter: (address = 'Kazan'::bpchar)
3	[...] Rows Removed by Filter: 100000
4	Planning Time: 1.244 ms
5	Execution Time: 25.520 ms

With b_tree id index:

Query Editor | Query History

```
1  explain analyze select id from customer where address in ('Kazan')
```

Data Output | Explain | Messages | Notifications

	QUERY PLAN text
1	Seq Scan on customer (cost=0.00..4192.00 rows=1 width=4) (actual time=23.926..23.927 rows=0 loops=1)
2	[...] Filter: (address = 'Kazan'::bpchar)
3	[...] Rows Removed by Filter: 100000
4	Planning Time: 1.007 ms
5	Execution Time: 23.945 ms

With hash index:

Query Editor | Query History

```
1  explain analyze select id from customer where address in ('Kazan')
```

Data Output | Explain | Messages | Notifications

	QUERY PLAN text
1	Seq Scan on customer (cost=0.00..4192.00 rows=1 width=4) (actual time=25.777..25.778 rows=0 loops=1)
2	[...] Filter: (address = 'Kazan'::bpchar)
3	[...] Rows Removed by Filter: 100000
4	Planning Time: 1.320 ms
5	Execution Time: 25.795 ms

Therefore,

The cost the same for each case.