Kahoot Week 4

1. Bubble sort has average runtime of?

$O(n^2)$

2. Selection sort and Insertion sort have same runtime in the worst case?

True

3. In best case, i.e. if we input a sorted array, Bubble sort has run-time $O(1)$, as we do not need to swap anything.

It is true that we don't swap anything, however, we still have $O(n^2)$ comparisons, thus the runtime cannot be constant.

4. There is a search algorithm with $O(n^2)$ runtime.

Any $O(n)$ or $O(\log n)$ search algorithm is also in $O(n^2)$.

5. Using subtrees as nodes, we can do Binary search in $O(\log \log n)$.

False. It has been proven in the lecture that the lower bound for searching, in the worst case, is $\Omega(\log n)$.

6. How does the array [19, 18, 20, 9, 7, 33, 1, 2, 6, 5] look like after one outer for-loop iteration of BubbleSort?

[18, 19, 9, 7, 20, 1, 2, 6, 5, 33]

7. Which sorting algorithm has following steps?

3	8	5	4	1	2	7	6
3	5	8	4	1	2	7	6
3	4	5	8	1	2	7	6

Insertion sort.

8. Which sorting algorithm has the following steps?

3	8	5	4	1	2	7	6
3	6	5	4	1	2	7	8
3	2	5	4	1	6	7	8

Selection sort.

9. Question 9

Contained mistake, sorry.

10. Asymptotic runtime?

Algorithm 1

```
for j = 1, ..., n do
    for k = j^2, j^2 + 1, ..., (j + 1)^2 do
        f()
```

$$\sum_{j=1}^{n} \sum_{k=j^2}^{(j+1)^2} 1 = \sum_{j=1}^{n} \sum_{k=j^2}^{j^2+2n+1} 1 = \sum_{j=1}^{n} \sum_{k=1}^{2j+2} 1 = \sum_{j=1}^{n} 2j + 2 = 2\left(\frac{n(n+1)}{2}\right) + 2n = n^2 + 3n \leq O\left(n^2\right)$$