Quiz Questions: Algorithms

1. The Worst case occurs in linear search algorithm when _____
   a. Item is somewhere in the middle of the list
   b. Item is not in the list at all
   c. Item is the last element in the list
   d. Item is the last element in the array or is not there at all

   Explanation: *The worst case is if the algorithm has to traverse the whole list. This is the case both if the searched element is the last, and if it does not occur. In both cases the algorithm performs the same number of operations, just that the outcome of the last conditional statement is different.*

   ---

2. To sort a list with n elements, the insertion sort begins with the _____ element.
   a. First
   b. Second
   c. Third
   d. Fourth

   Explanation: *Inspecting the pseudo-code we see that the algorithm starts with the second element. For the first element nothing is to be done, as a list with a single element is already ordered.*

   ---

3. Efficiently determining the position of the smallest element in a list, requires solving a
   a. Searching problem
   b. Sorting problem
   c. Optimization problem
   d. All of the above

   Explanation: *If you solve the problem blindly using known algorithms, you first determining the largest element, and then use a search algorithm to locate it. Therefore, it requires solving a searching problem. Of course, as determining the largest element also requires traversing the list, you can directly return the position. But still this also was a search.*

   ---

4. Binary search will perform fewer steps than linear search
   a. Always true
   b. The opposite is true
   c. Sometimes true
   d. True if input is ordered

   Explanation: On average binary search will perform fewer steps (as we will see next week). But if linear search is lucky, it can succeed fast (e.g. finding the first element) whereas binary search has to do multiple steps.

   ---

5. Before the last pass of bubble sort
   a. The first two elements can be out of order
   b. The last two elements can be out of order
   c. All elements are already ordered
   d. The last element needs to be put in the right position

Explanation: *If you careful inspect the example run, you see that in fact in the last pass bubble search touches only the last two elements, which are potentially still out of order.*

---

6. You have coins of 1, 3 and 5. For an amount of 9 the cashier's algorithm will return
   a. 3 x 3
   b. 9 x 1
   c. 1 x 5 and 4 x 1
   d. The smallest number of coins possible

Explanation: *Actually, the algorithm will return 1x5, 1x3, 1x1 which is the smallest number of coins possible (3). (sorry again for the mistake in marking the correct solution in Kahoot)*

---

7. Let $A = \{1, 2, 3\}$. The following is a maximum matching
   a. $\{(1, 2)\}$
   b. $\{(1, 2), (2, 3)\}$
   c. $\{(2, 3), (1, 1)\}$
   d. $\{(1, 2, 3)\}$

Explanation: *Actually, the others are not matchings. {(1, 2), (2, 3)} has element 2 in two different positions, {(2, 3), (1, 1)} has 1 in the same pair, and {(1, 2, 3)} is not a set of pairs.*

---

8. Finding the least number of courses needed to finish a semester, requires solving a
   a. Searching problem
   b. Optimization problem
   c. Marriage problem
   d. Halting problem

Explanation: *This is a classical optimization problem. We have a number of choices (the courses) and would like to know what their smallest number is (the optimization objective).*