CS3230 – Assignment 3
Due Date: 4 April 2018, before start of class

Student Number _____

Tutorial Group _____

Question	Marks
Q1	
Q2	
Q3	
Total	

1. (6 marks) Consider having a stack where the operation allowed is:

   $OP(m, x)$: which pops m items from the stack and then pushes one item x. The m items from the top of the stack are returned to the user. This operation assumes there are at least m items in the stack before the operation starts, otherwise the program ends.

   Here m can be 0, and the stack starts as empty.

   Note that the worst case time needed to do the operation can be $O(n)$, where the stack may have up to n items.

   Use the potential method done in class for amortized analysis to show that the amortized cost of $OP(m, x)$ is constant.

2. (6 marks) Suppose we have a list of n real numbers. Consider the problem of finding the largest sum which can be obtained when adding some consecutive elements in the list.

   For example, if the list of elements is $-3, 4, 5, -8, 12, -7, 3$

   Then the largest sum that can be obtained is $4 + 5 - 8 + 12 = 13$.

   Give an efficient algorithm to find the largest sum as above. Prove the correctness and time complexity bound of your algorithm.

   Your marks for this question will depend on how good your algorithm is in terms of time complexity.

3. (8 marks) An AND-OR Graph is a directed acyclic graph, where each non-terminal node (vertex) is labeled as either AND node or OR node (but not both). Here a node is terminal if it has no outgoing edges from it. A node v is a child of node u iff there is an edge from u to v.

   A *solution graph* for a node S in an AND-OR graph G, is a sub graph G' of G such that:

   > (1) S is in G';
   > (2) If a node v in G' is an AND node of G, then all of v's children in G also belong to G';
   > (3) If a node v in G' is an OR node of G, then at least one of v's children in G also belongs to G'.

   Intuitively, one can consider AND-OR graphs as methods of solving a problem. Solution graph represents one particular way of solving the problem.

   Show that the following problem is NP complete.

   > Instance: An AND-OR graph G, a node S in G, and a number k.
   > Question: Does there exist a solution graph for S in G which contains $\leq k$ nodes?