Quiz 8

There are two questions on this quiz, see second page.

1. Write an algorithm that, given a non-zero real number a, a real number c, and a positive integer n outputs the number $a^n + c$. You need not justify that your answer finds the correct number. Your solution will be graded on correctness and clarity. Using notation or programming contexts that you may have learned elsewhere is done at your own risk.   (10 pts.)

$\underline{\text{Input}}$: a, c, n with $a \in \mathbb{R} \setminus \{0\}$, $c \in \mathbb{R}$ and $n \in \mathbb{N}_{>0}$

$\underline{\text{Procedure}}$: Initialize $S = 1$.

$\underline{\text{Step 1}}$: For $i = 1, \ldots, n$,   % at iteration i
$$S = a^i$$
    Set S to $S * a$.   % at iteration $i = n$
$$S = a^n$$

$\underline{\text{Step 2}}$: Set S to $S + c$.   % now $S = a^n + c$

$\underline{\text{Output}}$: S.

2. Consider the following algorithm (written by Sal Barone) which takes as input numbers $a_1, a_2, \ldots, a_n$, $n \geq 1$, and outputs the natural number $SB(a_1, a_2, \ldots, a_n)$.

Algorithm: SB
Input: $a_1, a_2, \ldots, a_n$.
Procedure:
INITIALIZE: $S = 0$.
STEP 1: For $i = 1, \ldots, n$,
if $a_i = 5$ replace S with $S + 1$.
Output: S.

(a) What is the output if the input list is $1, 5, 4, 1, 4, 5, 1, 3, 5$? You do NOT have to justify your answer to this question. (4 pts.)

$$\boxed{3}$$

(b) Describe as clearly as you can what the algorithm *does*. That is, describe the relationship between the input and the output of the algorithm. (6 pts.)

The algorithm outputs the number of times "5" appears in the list.