Assignment 2
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1. (0.5 pts) Describe, in English, the language defined by the following grammar:

        <S> → <A> <B> <C>
        <A> → a <A> | a
        <B> → b <B> | b
        <C> → c <C> | c

        ANSWER: This grammar defines a set of rules that are in the order of the following: <A> <B> <C>. These nonterminal symbols denote terminal symbols of the corresponding chars: 'a' 'b' and 'c'. When looking specifically at the rule set of the nonterminal symbols you see it either produces one or more of the char related to that symbol's rule set. So in the first rule, it can produce any amount of a b, and c in order, the order listed before this (a's then b's then c's. Ex: aaaabbbcc , ex: abc , etc…

2. (1.2 pts) Consider the following grammar:

        ANSWER pt1: The second rule denotes any amount of b's and the same for rule three but switched, so <A> = any amount of b's or at least one and <B> = any amount of a's or at least one. The first rule denotes that any <A> (which is any number of b's) must be followed by a char of 'a'. It then continues that any <B> (which is any amount of a's) must be followed by a char of 'b'.

        <S> → <A> a <B> b
        <A> → <A> b | b
        <B> → a <B> | a

Which of the following sentences are in the language generated by this grammar? Show the derivation sequence or the parse tree for each that you claim to be generated.

        a. Baab : True
        b. bbbab : False because it is lacking either a following char of 'a' after the first sequence of b's or it is lacking <B> after the first char of 'a'.
        c. bbaaaaaS : False, would be true if the last 'S' char was a b.

d. bbaab : True

3. (1.5 pts) Compute the weakest precondition for each of the following assignment statements and postconditions:

a. a = 2 * (b - 1) - 1 {a > 3}
      2 * (b - 1) -1 > 3
               +1   +1
      = 2 * (b - 1) > 4
      2/2 * (b - 1) > 4/2
      = b - 1 > 2
      b - 1 > 2
       +1   +1
      = b > 3
ANSWER for a: Weakest Precondition: (b > 3)

b. b = (c + 10) / 3 {b < 6}
      (c + 10) /3 < 6
      -> do 3 *3 on left side and 3 * 6 on right side
      = c + 10 < 18
      -> now do 10 - 10 on left side and 18 - 10 on the right side
      = c < 8
ANSWER for b: Weakest Precondition: (c < 8)

c. a = a + 2 * b - 1 {a > 5}
      a + 2 * b - 1 > 5
      -> Start with 1 + 1 on the left side and 5 + 1 on the right side
      = a + 2 * b > 6
      -> now do 2 * b - 2 * b on the left side and 6 - 2 * b on the right side
      = a > 6 - 2 * b
ANSWER for c: Weakest Precondition: (a > 6 - 2b)

d. if (x < y) x = x + 1 else x = 3 * x {x < 0}
      Here there are 2 conditions with the if else statement.
  1. If x < y :
     x + 1 < 0
     = x < -1
  2. Else x >= y :
     3 * x > 0
     = x > 0

 Do not simply write the answers. SHOW your work.

4. (1.8 pts) To understand the value of counting loops, write a program that implements matrix multiplication using counting loop constructs. Then write the same program using only logical loops—for example, while loops. Use Java or C/C++. The matrices should be declared as double-dimensional arrays ([][]) and could be either float or int. You should also include a script that tests your code. Submit two files (both named CSIT313HW2_LastName) through Canvas

1. The first file should include the answers to the non-programming exercises. Each answer should include a clear indication of what problem you are answering.

2. The second file should be a zip file with all codes, input files (if any), scripts, and readme. Files should have proper headings, and comments (including author name, description, date, etc.) The readme should provide enough description on how to run everything. The code should be done on your docker environment that you set up for homework 1.