Department of Computer Science and Engineering
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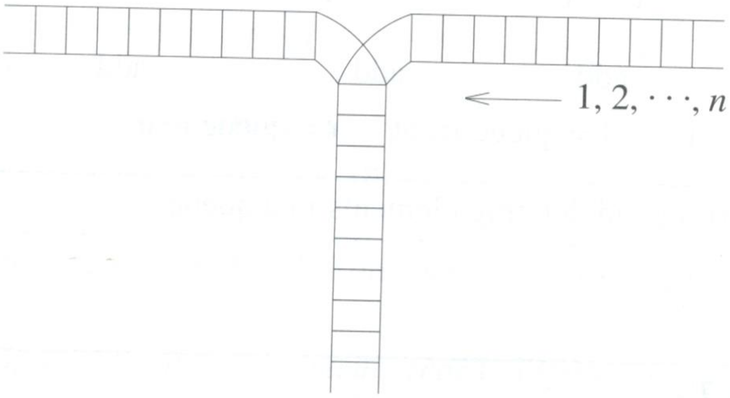
Data Structures Quiz, Chapter 3, Oct. 14, 2024

1. Please draw the expression tree of the infix expression ((A-B)*C-D)/(E+F)-G. Then give its prefix form and postfix form. (30%)

2. Consider the railroad switching network shown in the below figure. Railroad cars numbered 1, 2, 3, …, *n* are initially in the top right track segment (in the left to right order). Railroad cars can be moved into the vertical track segment one at a time from the right horizontal segments and then moved from the vertical segment to the left horizontal segment. The vertical segment operates as a stack as new cars enter at the top and cars depart the vertical segment from the top. For example, when *n*=3, we could move car 1 into the vertical segment, move 2 in, move 3 in, and then take the cars out producing the new order 3, 2, 1. Please write down all other possible orders that can be obtained. (30%)

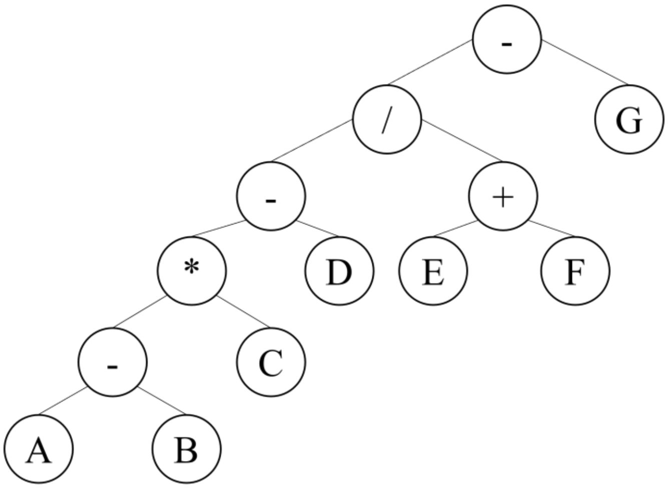


3. Please present a method for converting an infix expression to a postfix expression by using a stack. You should write down the algorithm and use the conversion of ((A-B)*C-D)/(E+F)-G as an example. (40%)

參考解答：

1. prefix: -/-*-ABCD+EFG //ch03, p. 3-32

postfix: AB-C*D-EF+/G-



2.

(1) push(1) pop( ) push(2) pop( ) push(3) pop( ) →1.2.3

(2) push(1) pop( ) push(2) push(3) pop( ) pop( ) →1.3.2

(3) push(1) push(2) pop( ) push(3) pop() pop( ) →2.3.1

(4) push(1) push(2) pop( ) pop( ) push(3) pop( ) →2.1.3

(5) push(1) push(2) push(3) pop( ) pop( ) pop( ) →3.2.1

3.

(1) 遇 operand, 直接 output

(2) 遇 operator

(a) 若此 operator 之 precedence 比 top of stack 高 ==> 此 operator 放入 stack.

(b) 否則, 將所有比此 operator 之 precedence 還高之 operator 全 pop 並 output, 再將 operator 放入 stack.

(3) ‘(‘: 直接放入 stack

(4) ‘)’: 所有在’(‘之上的 operator 全部 pop 並 output，但’(‘及’)’不必 output

(5) 最後將 stack 內所有 operator 取出，並 output

symb	postfix	stack
(		(
(		((
A	A	((
-	A	((-
B	AB	((-
)	AB-	(
*	AB-	(*
C	AB-C	(*
-	AB-C*	(-
D	AB-C*D	(-
)	AB-C*D-	
/	AB-C*D-	/
(	AB-C*D-	/(
E	AB-C*D-E	/(
+	AB-C*D-E	/(+
F	AB-C*D-EF	/(+
)	AB-C*D-EF+	/
-	AB-C*D-EF+/	-
G	AB-C*D-EF+/G	-
	AB-C*D-EF+/G-	