

Intermediate Math Circles

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COMPUTER PROGRAMS

The Centre for Education in Mathematics and Computing
Faculty of Mathematics, University of Waterloo

www.cemc.uwaterloo.ca



Computer Programs

A certain computer program is used to draw banners consisting of squares and triangles. The program makes use of the following five instructions:

Instruction	Meaning
S	Draw a large square
s	Draw a small square
T	Draw a large triangle
t	Draw a small triangle
N[I]	Repeat the instructions, I, exactly N times



Computer Programs

For example, the program `s 2[T t] S` draws the following banner:



Reading Computer Programs

1. Given the program `t 4[s] T 3[t S]` draw the corresponding banner.
2. Given the program `2[2[s S] t T]` draw the missing shapes in the following banner:



Writing Computer Programs

3. Create two different programs that will draw the following banner:



4. Given the incomplete program `?[2[?] t ?[s T ?]]` complete the missing instructions in order to draw the following banner:



Fixing Computer Programs

5. Suppose you want to draw the following banner:



You create the program `2[S T t] 2[T S s]` which incorrectly draws this banner:



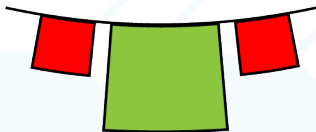
What are the mistakes in your program?



Enhancing Computer Programs

A new instruction named `if` is now available to you. The instruction `(a:b/c)` means that if the previous shape drawn was `a`, then the next shape drawn will be `b`. If the previous shape drawn was not `a`, then the next shape drawn will be `c`.

For example, the program `s (s:S/t) (t:T/s)` draws the following banner:



Enhancing Computer Programs

6. For each program in parts (a) through (f), decide whether or not it will draw the following banner:



- (a) $2[T (t:T/t)]$
- (b) $T (T:t/s) (t:T/S)$
- (c) $T 2[(t:T/t)]$
- (d) $t (t:T/s) (s:S/t)$
- (e) $T (T:t/S) (S:s/T)$
- (f) $3[(T:t/T)]$

