

Learning Objective Assessment: I2 (version 3)
MATH2603: Discrete Mathematics

I2: I can determine the output of a recursive algorithm for small input values, and use pattern recognition to determine the output in general. I can list elements contained in a recursively defined set, or give a recursive definition of an explicitly defined set.

1. A recursive algorithm is given below; the algorithm takes as input a pair (b, a) of natural numbers. Determine the output of `GogoRhythm` on inputs $(0, 3)$, $(1, 3)$, $(2, 3)$, and $(4, 3)$. Then state in a sentence what `GogoRhythm` does in general.

`GogoRhythm(b, a)`

```
if b=0:
    Return( 1 )
r:= GogoRhythm(a, b-1)
Return( a*r )
```

2. Consider the function $f: \mathbb{N} \rightarrow \mathbb{R}$ which is defined below. Find the values of $f(n)$ for $n \in \{1, 2, 3, 4, 5\}$, then give a formula for the output in general (you may use any functions we have used in class).

$$f(n) = \begin{cases} 0 & \text{if } n = 0 \\ 0 & \text{if } n = 1 \\ 1 + f(n - 2) & \text{if } n > 1 \end{cases}$$

3. Let $A = \{a, b, c\}$. Let $S \subset A^*$ be the set of strings over A in which no a ever appears to the right of a b or a c : so you can never see a substring $\dots bca \dots$, but $\dots abcbb \dots$ is acceptable. Give a list of six different elements of S . Then give a recursive definition for S .

Place work in this box. Continue on back if needed.

Criteria for Satisfactory: On questions 1 (resp. 2), no errors may be present in the computation of outputs of the algorithm (resp. function). On question 3, all strings listed must be valid elements of A^* . Of the three questions, at least two of three generalizations must be correct.