

## Examination ProgMod

October 6th, 2016

You may write your answers in Dutch or English. No documents or calculator.

### 1 Exercise 1

Write a simple program which

1. (0.5 pt) asks the user to input on the keyboard two real numbers  $(x, y)$  and two integers  $(n, m)$ ;
2. (0.5 pt) computes  $z = m \cdot \cos(x) + n \cdot \sin(y)$  and prints  $z$  it on the screen;
3. (0.5 pt) prints 'too big' if  $z$  exceeds  $m + n$

### 2 Exercise 2

1. (1 pt) Write a function which takes as argument an integer  $n$  and returns  $n!$  ("factorial  $n$ ")
2. (0.5 pt) Write a small program which makes use of this function

### 3 Exercise 3

1. (1pt) Write a subroutine which takes as arguments an integer  $m$  and a real  $x$  and computes  $\sqrt{m^x + x^m}$
2. (1pt) Write a small program which makes use of this subroutine

### 4 Exercise 4

Write a program according to the following specifications:

1. (0.5 pt) We wish to store in the arrays `coor dx`, `coor dy` and `coor dz` the  $x, y, z$  coordinates of a yet unknown number of points. Declare these arrays.
2. (0.5 pt) Have the user choose the size  $N$  (i.e. the user enters this number with the keyboard) of the arrays and fill them with numbers so that all points are in the domain  $[0 : 3.5] \times [0 : 6.28] \times [0 : 1.15]$  and have different coordinates.
3. (1pt) Open a file (name it as you wish) and use a do-loop to write the coordinates of these points on three columns
4. (1pt) compute the following quantities:

$$\alpha = \sum_{i=1}^N \left( \frac{\pi}{2} |x_i| + \frac{\pi}{3} |y_i| + \frac{\pi}{4} |z_i| \right) \quad \beta = \frac{1}{N} \sqrt{\sum_{i=1}^N (x_i^2 + y_i^3 + z_i^4)}$$

### 5 Exercise 5

As you already know, the symbol  $\sum$  stands for a summation, e.g.  $\sum_{i=1}^n i = 1 + 2 + 3 \dots + n$ . One can also define the symbol  $\prod$  so that:

$$\prod_{i=1}^n i = 1 \times 2 \times 3 \times \dots \times n$$

1. (0.5 pt) Write a program which prompts the user for a value  $n$  and returns  $\prod_{i=1}^n i$
2. (0.5 pt) In the same program compute

$$\frac{\prod_{i=1}^n (2i + 1)}{\sum_{i=1}^n (2i - 1)}$$

## 6 Exercise 6

1. (0.5 pt) Write a function *stupid\_func* which takes an integer  $n$  as argument and returns:  $n - 1$  if  $n$  is even,  $2n$  if  $n$  is odd
2. (1 pt) write a program which declares an integer array *myarray* of length 9 and place the value 3 in *myarray(1)*.  
Fill *myarray(2)* with the value you obtain by calling *stupid\_func* on *myarray(1)*.  
Fill *myarray(3)* with the value you obtain by calling *stupid\_func* on *myarray(2)*.  
Fill *myarray(4)* with the value you obtain by calling *stupid\_func* on *myarray(3)*, etc ...  
Automatize this process so as to fill the whole array this way.  
What values does *myarray* contain in the end ? (the idea is to run the code in your head or on paper)



### Recommendations:

- Every single used variable has to be defined.
- Is it an integer ? a real ? a static array ? an allocatable array ? etc ...
- Comment your code appropriately.
- Points will be deducted for unclear/unreadable statements.
- Every single used variable has to be defined (I insist).