

Examination "Programming and modelling - module 1"  
January 5, 2012, 9:00-10:00

## 1 Introduction

Imagine you want make a computer program that can perform simple data processing on measurement data that are read from an input file. The measurement data are represented by a time series  $s_i = s(t_i)$ ,  $i = 1, \dots, N$  that correspond to data measured over a certain time interval.

A single time series is stored as a 2-column text file, containing real number data, where the first column represents the measurement times  $t_i$ ,  $i = 1, \dots, N$  and the second column contains the measurement data values  $s_i$ ,  $i = 1, \dots, N$ .

Suppose you want to process the measurement time series by transforming it to a standard form of so called  $z$  values, with zero mean value and unit standard deviation. To this end you want to transform the input time series data  $s_i$  into an output time series  $z_i = (s_i - \mu)/\sigma$ , where  $\mu = \frac{1}{N} \sum_{i=1}^N s_i$  and  $\sigma = \sqrt{\frac{1}{N-1} \sum_{i=1}^N (s_i - \mu)^2}$  are the mean value and standard deviation of the input data respectively.

After procesing the data you want to write the resulting time series to an output file with an identical file structure as used for the input data.

## 2 Assignment

Write a fortran program for the data processing task described in the introduction. The program must be created according to the following specifications:

- 1 • The program applies two, fixed length, 1-D arrays for the measurement time values and the measurement data values respectively.
- 2 • The program reads the number of available data,  $N$ , from the *standard input device* (unit 5) and checks the parameter  $N$  against the declared length of the arrays. This check involves printing an error message and a program stop in case  $N$  exceeds the declared array length.
- 3 • The program reads the input time series data from an input file named `timeseries_in.dat` and writes the processed time series to an output file name `timeseries_out.dat`
- 4 • The output file is written using a fortran subroutine `writdat` with the following routine header,

```
subroutine writdat(ndata,xdata,ydata,filename)
integer ndata
real xdata(*),yda*a(*)
character(LEN=*) filename
```

N.B. you don't have to write this subroutine.

- 5
- $\mu$  and  $\sigma$  are computed in separate do-loop's that iterate over the available data points and the transformed output data values are computed in a third do-loop overwriting the input data, thereby using a single array for both input- and output data.
  - Write the full fortran source text (except for routine writdat) and use fortran comment and source text indentation to make the program code more easily readable.
  - Give some extra explanations, separate from the fortran texts, about the design decisions you make in the construction of the program.