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## Week 1 Exercises

### fiveDigit.c

There is a 5-digit number that satisfies  $4 * abcde = edcba$ , that is, when multiplied by 4 yields the same number read backwards. Write a C-program to find this number.

### innerProdFun.c

Write a C-function that returns the *inner product* of two  $n$ -dimensional vectors **a** and **b**, encoded as 1-dimensional arrays of  $n$  floating point numbers.

Use the function prototype **float innerProduct(float a[], float b[], int n)**.

By the way, the inner product of two vectors is calculated by the sum for  $i=1..n$  of  $a_i * b_i$

### matrixProdFun.c

Write a C-function to compute **C** as the *matrix product* of matrices **A** and **B**.

Use the function prototype **void matrixProduct(float a[M][N], float b[N][P], float c[M][P])**

You can assume that  $M, N, P$  are given as symbolic constants, e.g.

```
#define M 3
#define N 4
#define P 4
```

By the way, the product of an  $m \times n$  matrix **A** and an  $n \times p$  matrix **B** is the  $m \times p$  matrix **C** such that  $C_{ij}$  is the sum for  $k=1..n$  of  $A_{ik} * B_{kj}$  for all  $i \in \{1..m\}$  and  $j \in \{1..p\}$

### able.c

Write a C-program that outputs, in alphabetical order, all strings that use each of the characters 'a', 'b', 'l', 'e' exactly once.

How many strings are there actually?

## collatzeFib.c

- a. Write a C-function that takes a positive integer  $n$  as argument and prints a series of numbers generated by the following algorithm, until 1 is reached:

- if  $n$  is even, then  $n \leftarrow n/2$
- if  $n$  is odd, then  $n \leftarrow 3*n+1$

(Before you start programming, calculate yourself the series corresponding to  $n=3$ .)

- b. The Fibonacci numbers are defined as follows:

- $\text{Fib}(1) = 1$
- $\text{Fib}(2) = 1$
- $\text{Fib}(n) = \text{Fib}(n-1) + \text{Fib}(n-2)$  for  $n \geq 3$

Write a C program that calls the function in Part a. with the first 10 Fibonacci numbers. The program should print the Fibonacci number followed by its corresponding series. The first 4 lines of the output is as follows:

```
Fib[1] = 1:
Fib[2] = 1:
Fib[3] = 2: 1
Fib[4] = 3: 10 5 16 8 4 2 1
```

## fastMax.c

Write a C-function that takes 3 integers as arguments and returns the largest of them. The following restrictions apply:

- You are permitted to only use assignment statements, a return statement and Boolean expressions
- You are not permitted to use if-statements, loops (e.g. a while-statement), function calls or any data or control structures

(You might find this exercise a 'brain-twister'.)