CO222: Programming Methodology

Lab: 10 (Recursive Functions)

Exercise #1: Greatest Common Divisor

- The recurrence relation for Greatest Common Divisor (GCD) of two non-negative integers *a* and *b*, not both zero, is given below:

$$\text{GCD}(a,b) = \begin{cases} a, & b = 0 \\ \text{GCD}(b, a\%b), & \text{otherwise} \end{cases}$$

- Write a function `int gcd(int a, int b)` to compute the GCD of *a* and *b*. Skeleton program **GCD.c** is given.

Exercise #2: Power

- The math function double `pow(double x, double y)` computes x^y. Write your own, simpler function double `mypow(double x, int n)` to compute x^n, where *n* is a non-negative integer.
- Skeleton program **Pow.c** is given. The recurrence relation is not given. You should derive it before writing the function.

Exercise #3: Tracing

- Given the following 2 recursive functions, trace `mystery1(3902)` and `mystery2(3902)` using the trace tree method.
- Note that the order of the statements does matter.

```c
void mystery1(int n) {
    if (n>0) {
        printf("%d", n%10);
        mystery1(n/10);
    }
}
```

```c
void mystery2(int n) {
    if (n>0) {
        mystery2(n/10);
        printf("%d", n%10);
    }
}
```

Exercise #4: Sum Digits

- Write a recursive function `int sum_digits(int n)` that sums up the digits in *n*, assuming that *n* is a non-negative integer.
- Skeleton program **SumDigits.c** is given.
- Sample runs:

```
Enter a non-negative integer: 6543
Sum of its digits = 18

Enter a non-negative integer: 3708329
Sum of its digits = 32
```

Exercise #5: Sum Array

- Complete the program **`SumArray.c`** to read data into an integer array with at most 10 elements, and sum up all values in the array, using a recursive function.
- Sample runs:

```
Enter number of elements: 6
Enter 6 values: 4 3 -2 0 1 3
Array read: 4 3 -2 0 1 3
Sum = 9

Enter number of elements: 8
Enter 8 values: 11 25 56 8 12 7 31 16
Array read: 11 25 56 8 12 7 31 16
Sum = 166
```

What to submit:

Submit a single zip file (named **14xxxlab10.zip**) containing 5 files, one for each exercise.

Deadline:

The deadline for the submission is Saturday (06), 20:00h.