Homework 1
COSE212, Fall 2016

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Due: 09/30, 24:00

Problem 1 The Fibonacci numbers can be defined as follows:

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

Write in OCaml the function

```
fib: int -> int
```

that computes the Fibonacci numbers.

Problem 2 Consider the following triangle (it is called Pascal's triangle):

$$\begin{array}{ccccccc} & & & 1 & & & \\ & & & 1 & 1 & & \\ & & 1 & 2 & 1 & & \\ & & 1 & 3 & 3 & 1 & \\ & 1 & 4 & 6 & 4 & 1 & \\ & & & \cdots & & & \end{array}$$

where the numbers at the edge of the triangle are all 1, and each number inside the triangle is the sum of the two numbers above it. Write a function

```
pascal: int * int -> int
```

that computes elements of Pascal's triangle. For example, `pascal` should behave as follows:

```
pascal (0,0) = 1
pascal (1,0) = 1
pascal (1,1) = 1
pascal (2,1) = 2
pascal (4,2) = 6
```

Problem 3 Write a function

```
prime: int -> bool
```

that checks whether a number is prime (n is prime if and only if n is its own smallest divisor). For example,

```
prime 2 = true
prime 3 = true
prime 4 = false
prime 17 = true
```

Problem 4 Write a function

```
sigma : (int -> int) -> int -> int -> int
```

such that `sigma f a b` computes

$$\sum_{i=a}^{b} f(i).$$

For instance,

```
sigma (fun x -> x) 1 10
```

evaulates to 55 and

```
sigma (fun x -> x*x) 1 7
```

evaluates to 140.