# The Function problems

Coding the Matrix, 2015

For auto-graded problems, edit the file The Function problems.py to include your solution.

### Problem 1: tuple\_sum(A, B)

input: lists A and B of the same length, where each element in each list is a pair (x,y) of numbers output: list of pairs (x,y) in which the first element of the  $i^{th}$  pair is the sum of the first element of the  $i^{th}$  pair in A and the first element of the  $i^{th}$  pair in B example: given lists [(1,2),(10,20)] and [(3,4),(30,40)], return [(4,6),(40,60)].

#### Problem 2: inv\_dict(d)

input: dictionary d representing an invertible function  ${\tt f}$  output: dictionary representing the inverse of  ${\tt f}$ , the returned dictionary's keys are the values of d and its values are the keys of d example: given an English-French dictionary

{'thank you': 'merci', 'goodbye': 'au revoir'} return a French-English dictionary

{'merci':'thank you', 'au revoir':'goodbye'}

### Problem 3: First write a procedure row(p, n) with the following spec:

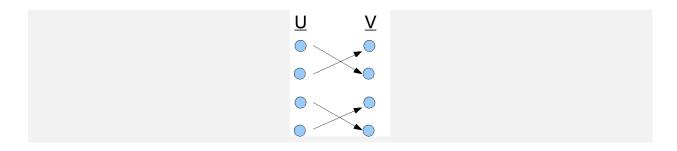
- input: integer p, integer n
- output: n-element list such that element i is p+i
- example: given p = 10 and n = 4, return [10, 11, 12, 13]

Next write a comprehension whose value is a 15-element list of 20-element lists such that the  $j^{th}$  element of the  $i^{th}$  list is i+j. You can use row(p) in your comprehension.

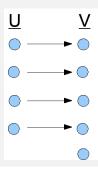
Finally, write the same comprehension but without using row(p). Hint: replace the call to row(p, n) with the comprehension that forms the body of row(p, n).

## **Functional Inverses**

**Ungraded problem:** Is the following function invertible? If yes, explain why. If not, can you change domain and/or codomain of the function to make it invertible?



**Ungraded problem:** Is the following function invertible? If yes, explain why. If not, can you change domain and/or codomain of the function to make it invertible?



## **Functional composition**

**Ungraded problem:** Let  $f: \mathbb{R} \to \mathbb{R}$  where f(x) = abs(x). Is there a choice of domain and co-domain for the function g(x) with rule  $g(x) = \sqrt{x}$  such that  $g \circ f$  is defined? If so, specify it. If not, explain why not. Could you change domain and/or codomain of f or g so that  $g \circ f$  will be defined?

**Ungraded problem:** Consider functions f and g in the following figure:



Is  $f \circ g$  defined? If so, draw it, otherwise explain why not.

**Problem 4:** A function f(x)=x+1 with domain  $\{1,2,3,5,6\}$  and codomain  $\{2,3,4,6,7\}$  has the following probability function on its domain:  $\Pr(1)=0.5$ ,  $\Pr(2)=0.2$  and  $\Pr(3)=\Pr(5)=\Pr(6)=0.1$ . What is the probability of getting an even number as an output of f(x)? An odd number?

**Problem 5:** A function  $g(x)=x \mod 3$  with domain  $\{1,2,3,4,5,6,7\}$  and codomain  $\{0,1,2\}$  has the following probability function on its domain:  $\Pr(1)=\Pr(2)=\Pr(3)=0.2$  and  $\Pr(4)=\Pr(5)=\Pr(6)=\Pr(7)=0.1$ . What is the probability of getting 1 as an output of g(x)? What is the probability of getting 0 or 2?