# CS 362

**Programming Languages**

**Team Project 1**

Write the code in SML and demonstrate by examples. Each exercise contributes 10% to the final score.

1. Write a function min3 of typeint \* int \* int -> int that returns the smallest of the three integers.
2. Write a function cycle of type ‘a list \* int -> ‘a list that takes a list and an integer as input and returns the same list, but with the first element cycled to the end of the list *n* times. For example, cycle ([1,2,3,4,5,6], 2) should return the list [3,4,5,6,1,2].
3. Write a function isPrime of type int -> bool that returns true if and only if its integer parameter is a prime number. Your function need not behave well if the parameter is negative.
4. Write a function select of this type:

‘a list \* (‘a -> bool) -> ‘a list

that takes a list and a function *f* as a parameter. Your function should apply *f* to each element of the list and should return a new list containing only those elements of the original list for which *f* returned true. The elements of the new list can be given in any order. For example, evaluating

select ([1,2,3,4,5,6,7,8,9,10], is Prime)

should result in a list like [7,5,3,2].

1. Write a function band of type bool list -> bool that takes a list of Boolean values and returns the logical OR of all of them. If the list is empty, your function should return true.
2. Write a function dupList of type ‘a list -> ‘a list whose output list is the same as the input list, but with each element of the input list repeated twice in a row. For example, if the input list is [1,3,2], the output list should be [1,1,3,3,2,2]. If the input list is [], the output list should be [].
3. Write a function max of type int list -> int that returns the largest element of a list of integers. Your function need not to behave well if the list is empty.
4. Write a function convert of type (‘a \* ‘b) list -> ‘a list \* ‘b list, that converts a list of pairs into a pair of lists, preserving the order of the elements. For example, convert [(1,2), (3,4), (5,6)] should evaluate to ([1,3,5], [2,4,6]).
5. A binary search tree is a binary tree with special properties. It may be Empty. It may be a Node containing a left subtree, a data item *x*, and a right subtree. 1n this case all the data items in the tree are different, all the items in the left subtree are smaller than *x*, all the items in the right subtree are greater than *x*, and the left and right subtrees arc also binary search trees. Write a function makeBST of type

'a list → ('a \* 'a → bool) → 'a tree

that organizes the itemsin the list into a binary search tree. The tree need not bebalanced. You may assume that no item in the tree is repeated.

1. Write a function searchBST of type

''a tree → (''a \* ''a → bool) → ''a → bool

that searches a binary search tree for a given data element. Refer to Exercise 5 for the definition of a binary search tree. You should not search every node in the tree*,* but only those nodes that, according to the definition, might contain the element you are looking for.

Upload to Canvas as a single .sml file.

**How to collaborate:** Do not simply distribute the problems among the team members. Each of you should try to solve all problems on your own. Then, meet and discuss the solutions and only submit the best solution for each problem. This is how you will learn best and prepare for your midterm exam.