

COMP 3958: Lab 2

Submit a file named `lab2.ml` containing your source code. Except for `hd`, `tl`, `map`, `rev`, `sort`, `length`, `fold_left` and `fold_right` in the `List` module of the standard library, you may only call functions that you implement yourself from basics. Your file must compile without warnings or errors. If not, you may receive no credit for this lab exercise. Maximum score: 13.

1. (a) Implement a function `min_elt` with signature

```
val min_elt : 'a list -> 'a
```

that returns the smallest element in a non-empty list.

- (b) Implement a function `remove` with signature

```
val remove : 'a -> 'a list -> 'a list
```

so that `remove x l` removes the first occurrence of `x` in the list `l`, i.e., it returns a list that is the same as `l` except with the first occurrence of `x`, if any, removed.

- (c) Using (a) and (b), implement a form of “selection sort” to sort a list (in ascending order). The function has signature

```
val selection_sort : 'a list -> 'a list
```

The idea of selection sort is to select the smallest element of the list and move it to the front, then repeat the step for the rest of the list. (Clearly, you are not allowed to use `List.sort`.)

2. (a) Using either of `fold_left` or `fold_right` in the `List` module, implement a function `group` with signature

```
val group : 'a list -> 'a list list
```

that groups consecutive elements in a list that are the same (using the `=` operator) together into a sub-list. An example for a list of integers,

```
group [12; 34; 34; 34; 5; 12; 12; 6; 78; 90; 90]
```

returns:

```
[[12]; [34; 34; 34]; [5]; [12; 12]; [6]; [78]; [90; 90]].
```

Notice that in the example, not all 12's are grouped together, only consecutive 12's.

- (b) Implement a function `frequencies` with signature

```
val frequencies : 'a list -> ('a * int) list
```

that, given a list of elements, counts how many times each element occurs in the list. `frequencies` returns a list of pairs, where each pair is of the form `(elt, count)`, where `count` is the number of times the element `elt` occurs in the list. The order of the pairs in the returned list is unspecified, i.e, they can be in any order.

For Example,

```
frequencies [23; 12; 15; 12; 45; 15; 13; 45; 15; 12; 15; 15]
```

returns something like

```
[(12, 3); (13, 1); (15, 5); (23, 1); (45, 2)]
```

(Hint: Use `List.sort` to sort the list first.)