CSCI 4230 – Assignment 5

Instructions

For this assignment you must write the following functions in OCaml:

1. Write a function called `quadratic` that takes three arguments representing the three coefficients `a`, `b`, and `c` of a quadratic equation and uses the quadratic formula to calculate the two roots of the equation. If the discriminant $b^2 - 4ac$ is negative, raise an exception called `No_Real_Roots`. Otherwise return a tuple containing the two roots, even if the roots are identical.
2. Write a function called `third` that returns the third element of a tuple containing three items.
3. Write a recursive function called `reverse` that takes a list as an argument and returns a list containing the items in the original list in reverse order. You may not use any built-in list functions to do this, but you may use the `@` operator to append two lists.
4. Write a recursive function called `member` that takes an item and a list as arguments and returns true if the item is in the list and false otherwise. Use pattern matching to determine if the list is empty or not. You may not use any built-in list functions.
5. Write a recursive function called `union` that takes two lists as arguments and returns a list containing all items that appear in *either* list with no duplicates. You may assume that each or the arguments contains no duplicates, but there may be items that appear in both lists. You may use the `member` function defined in the previous problem, but you may not use any built-in list functions.
6. Write a recursive function called `intersect` that takes two lists as arguments and returns a list containing all items that appear in *both* lists with no duplicates. The same assumptions and restrictions apply as the previous problem.
7. Write a recursive function called `partition` that takes a pivot item and a list as arguments, and returns a tuple containing a list of items from the list that are less than the pivot and a list of items from the list that are greater than or equal to the pivot. If the original list contains duplicate items then the partitions should also contain duplicate items. If the original list is empty, both of the partitions should be empty. You may not use any built-in list functions.
8. Write a recursive function called `quicksort` that takes a list and sorts it by using the first item in the list as a pivot, partitioning the remaining items using that pivot, sorting the partitions, and appending the first partition to the pivot and the second partition. You may use the `partition` function from the previous problem, but you may not use any built-in list functions.

What to Hand In

Implement all of the functions described above in a source file called `yourlastnameAssign5.ml` with your actual last name. Make sure to put your name, CSCI 4230, and Assignment 5 in the comments (comments in OCaml start with `(*` and end with `*)`). Upload the source file to D2L to the dropbox called Assignment 5.