2 Foundations of Computer Science (LCP)

(a) Write brief notes on programming with lazy lists in ML. Your answer should include the definition of a polymorphic type of infinite lazy lists, a function to return the tail of a lazy list, a function to create the infinite list of all positive integers, and an apply-to-all functional analogous to the list functional map.

(b) Write a function diag that takes a lazy list of lazy lists,

\[
[[z_{11}, z_{12}, z_{13}, \ldots]],
[[z_{21}, z_{22}, z_{23}, \ldots]],
[[z_{31}, z_{32}, z_{33}, \ldots]], \ldots
\]

and returns the diagonal, namely the lazy list \([z_{11}, z_{22}, z_{33}, \ldots]\).

(c) Write a function that takes two lazy lists \([x_1, x_2, x_3, \ldots]\) and \([y_1, y_2, y_3, \ldots]\) and a function \(f\) of two arguments; it should return a lazy list of lazy lists like (*) above, with \(z_{ij} = f(x_i, y_j)\).

(d) Write a function that converts a lazy list of lazy lists like (*) above to a lazy list whose elements are all of the \(z_{ij}\), enumerated in some order.