Math 6833 assignments

31. Use `foldr1` to define the composition function
    `compose :: (a -> a) -> Int -> (a -> a)`, where `compose f n` is the function that
    composes `f` with itself `n-1` times (that is, `compose f 3` is $f \circ f \circ f$).

32. Load the module `Matrix` (on the links page) and use `foldr` to define
    `matrixPower :: Matrix -> Int -> Matrix`, where `matrixPower mat n` is the ma-
    trix `mat` raised to the nth power. (Hint: one solution is a `foldr` using the function
    `(\y -> matrixProduct mat)` applied to the list `[1..n]`. Another solution uses `foldr1`
    to fold `matrixProduct` into a list that consists of replicated copies of `mat`.

33. Determine what the following function does, where `splitString` is the function from
    problem 31:
    ```
    mystery str = init ( foldr f "" (splitString str) )
      where
      f x xs = x ++ " " ++ xs
    ```

34. Determine what the following function does:
    ```
    foldhappy n = foldr ((:).(morefold n)) [ ] [1..n]
      where
      morefold n i = foldr ((:).(matcher i)) [ ] [1..n]
      matcher i j = if i == j then 1 else 0
    ```

35. Download the module `Surface.hs`.

    (i) Define some examples of surfaces, including a Seifert surface for some knot, and
        use them test some of the functions in `Surface.hs`.

    (ii) Write functions
        ```
        obSurface ::  Int -> Int -> Surface
        nbSurface ::  Int -> Int -> Surface
        ```
        that construct orientable and nonorientable surfaces of genus g with k boundary
        components.

    (iii) Compare your `obSurface` and `nbSurface` with the ones in `Surface.hs`. If yours
        are better, please email them to me.