# Exercise (Week 2)

**DUE**: Tue June 18 14:00:00

## Getting Started

Before you begin, make sure that you installed Haskell according to the Haskell Setup instructions. For this and next week's exercises, you might find it helpful to have a look at the first six chapters of Learning Haskell, as the graphics library used is similar.

To get started, please follow the instructions corresponding to your particular Haskell setup.

CSE Stack

Download the exercise tarball and extract it to a directory on your local machine. This tarball contains a file, called `Ex01.hs`, wherein you will do all of your programming.

To test your code, run the following shell commands to open a GHCi session:

```
$ stack repl
Configuring GHCi with the following packages: Ex01
Using main module: 1. Package 'Ex01' component exe:Ex01 ...
GHCi, version 8.2.2: http://www.haskell.org/ghc/  :? for help
[1 of 2] Compiling ShapeGraphics (ShapeGraphics.hs, interpreted)
[2 of 2] Compiling Ex01          (Ex01.hs, interpreted)
Ok, two modules loaded.
*Ex01 ShapeGraphics> writeToFile housePic
```

Calling `writeToFile` as demonstrated above will write the provided picture (in this case `housePic`) to a file called `ex01.png` in the directory in which you invoked GHCi.

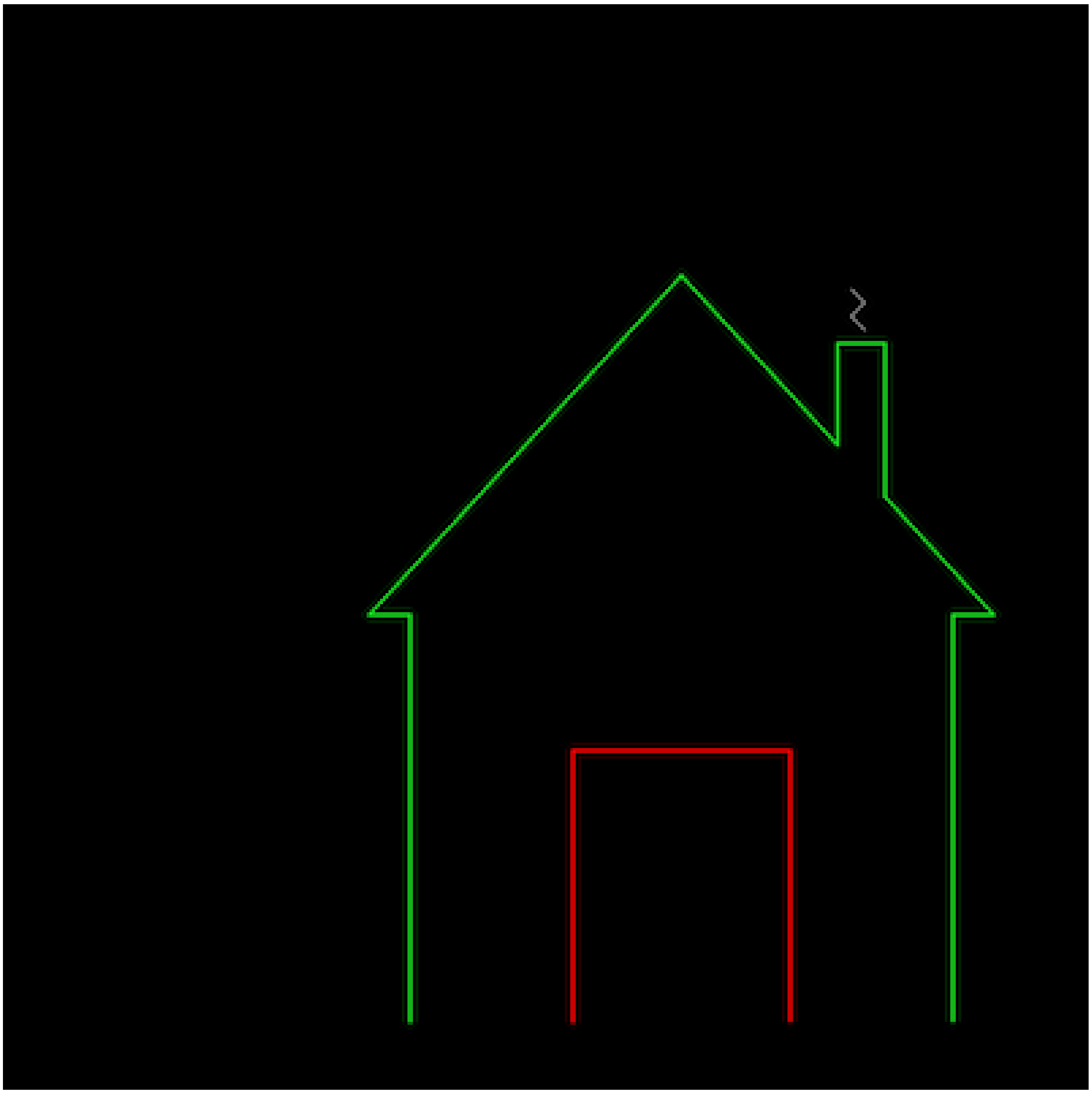
Note that you will only need to submit `Ex01.hs`, so only make changes to that file.

As a first step, look at the definition of the various data types in `Ex01.hs`. You can safely ignore the definition of the function `drawPicture`. All you need to know is that it takes as first parameter a floating point value which sets the line width of the picture, and as second parameter a `Picture`, or a list of `PictureObject` values, and returns a `.png` image of the resulting picture. The function `writeToFile` further saves the resulting image to disk.

## Part 1: Simple Picture (3 Marks)

Complete the definition of picture `housePic` in `Ex01.hs` such that it is a list of two picture objects: `house`, a path defined by the co-ordinates in `houseCOs`, coloured `green`, and with solid line style, and `door`, a path defined by the door coordinates, coloured `red`, and with solid line style. Use `drawPicture` or `writeToFile` (as demonstrated above) to check your definition.

As a next step, define a new picture `chimneyHouse`, which has an a `chimney` and `smoke`, so that it looks as follows:



The additional four coordinates needed for the chimney are the following: `(615, 325)`, `(615, 250)`, `(650, 250)` and `(650, 363)`.

For the smoke, use the four coordinates `(635, 240)`, `(625, 230)`, `(635, 220)`, `(625, 210)` and the colour `grey` already pre-defined in `Ex01.hs`.

**Important**: Make sure to use exactly the given coordinates; otherwise, automarking will not give you any marks.

## Part 2: Moving Objects (3 Marks)

You are given a function which moves a point along a given vector and returns the new point. Use this function to complete the definition of the function:

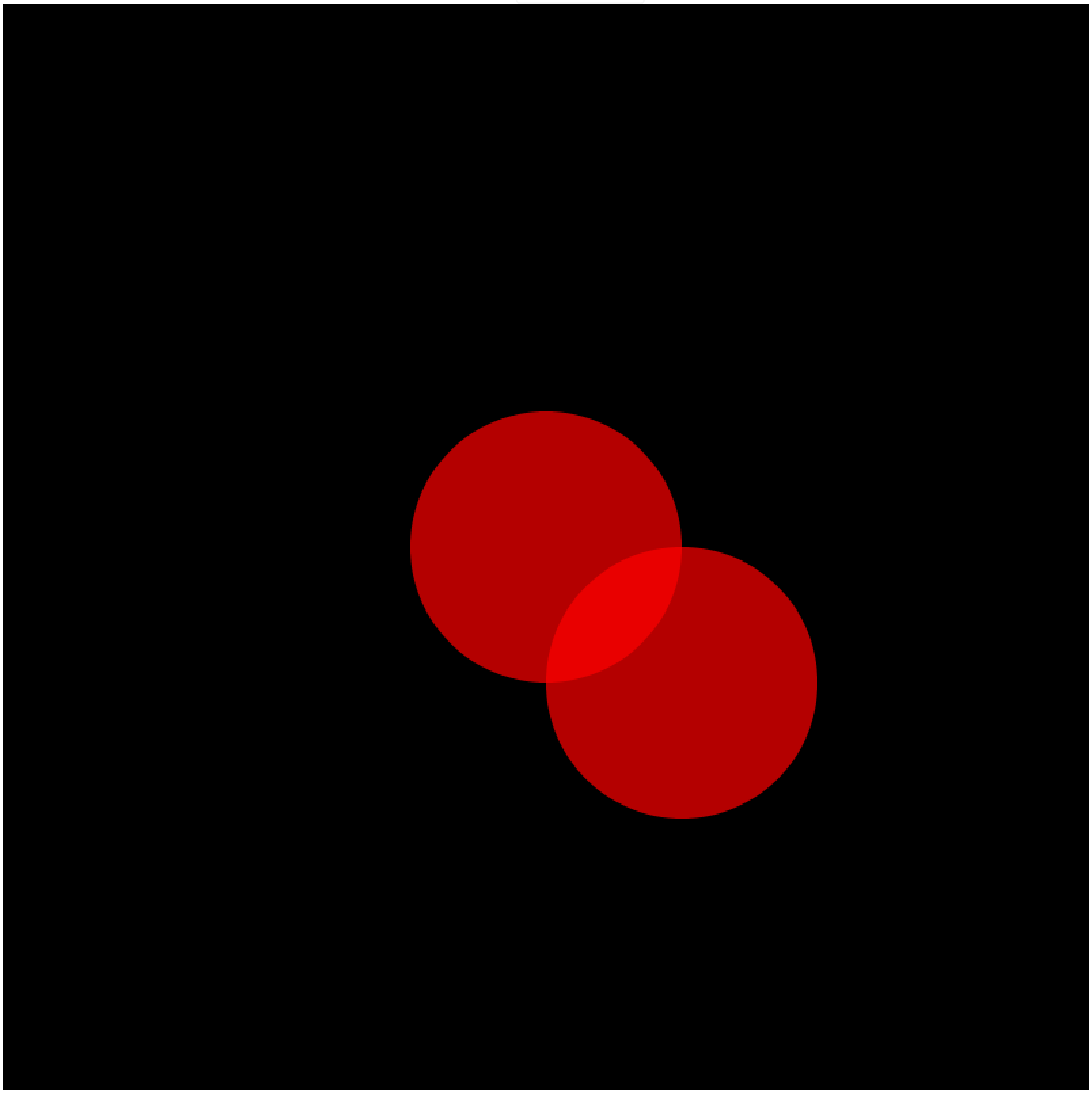
```
movePictureObject :: Vector -> PictureObject -> PictureObject
```

which moves a picture object. You need to provide a rule for every possible picture object (the pattern matching for path is already part of the given definition).

The following GHCi Session:

```
GHCi, version 8.2.2: http://www.haskell.org/ghc/  :? for help
[1 of 2] Compiling ShapeGraphics (ShapeGraphics.hs, interpreted)
[2 of 2] Compiling Ex01          (Ex01.hs, interpreted)
Ok, two modules loaded.
*ShapeGraphics> let myRed = red { opacityC = 180 }
*ShapeGraphics> let xy = (Point 400 400)
*ShapeGraphics> let circ = Circle xy 100 myRed Solid SolidFill
*ShapeGraphics> let v = (Vector 100 100)
*ShapeGraphics> writeToFile [circ, movePictureObject v circ]
*ShapeGraphics> :q
```

Ought to produce the following image in `ex01.png` :



**Hint**: Path and polygon are the more complicated cases - circle is pretty straight forward. For both path and polygon, you may find the pre-defined function `map :: (a -> b) -> [a] -> [b]` useful (as discussed in the lecture).

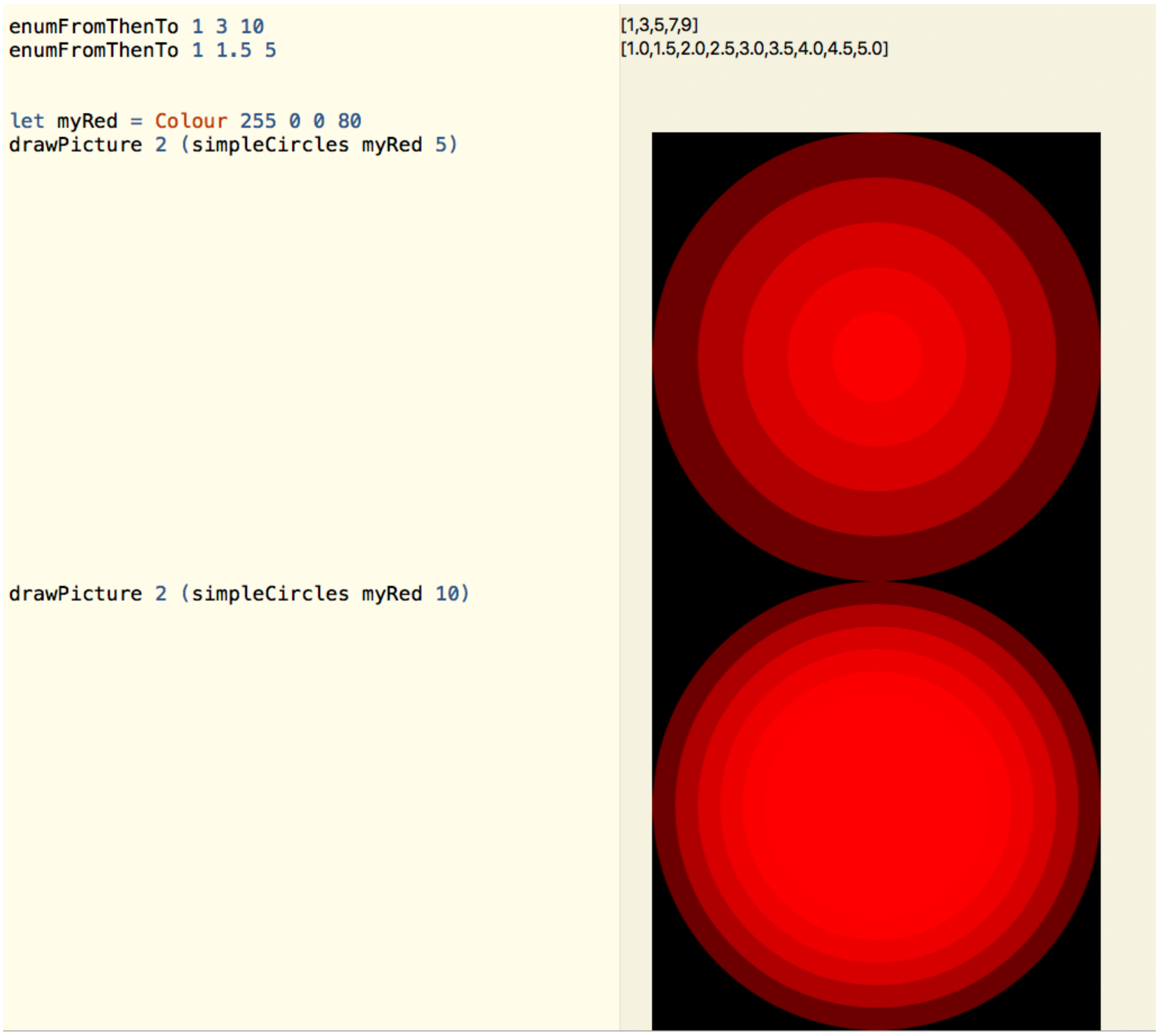
## Part 3: Generating a Picture (3 Marks)

Write a function `simpleCirclePic :: Colour -> Float -> Picture` , such that `simpleCirclePic col n` for a positive floating point number `n` generates the picture consisting of overlapping circles:

```
[Circle (Point 400 400) (1     * (400/n)) col Solid SolidFill,
 Circle (Point 400 400) (2     * (400/n)) col Solid SolidFill,
 Circle (Point 400 400) (3     * (400/n)) col Solid SolidFill,
 ....
 Circle (Point 400 400) ((n-1) * (400/n)) col Solid SolidFill,
 Circle (Point 400 400) (n     * (400/n)) col Solid SolidFill]
```

To test it, use a colour with low opacity value, for example `Colour 153 0 153 100`.

**Hint**: You can define this function using explicit recursion, but it is much easier to use the `map` function we discussed in the lecture, and the function `enumFromThenTo`. The expression `enumFromThenTo start next upperBound` generates the list `[start, next, start + 2 * (next - start),..]` up to `upperBound`.



```
enumFromThenTo 1 3 10
enumFromThenTo 1 1.5 5


let myRed = Colour 255 0 0 80
drawPicture 2 (simpleCircles myRed 5)
```

```
drawPicture 2 (simpleCircles myRed 10)
```

```
[1,3,5,7,9]
[1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5,5.0]
```

## Submission Instructions

Submit *only* the Haskell module file called `Ex01.hs` (*not* the entire project).

You can submit your exercise by typing:

```
$ give cs3141 Ex01 Ex01.hs
```

on a CSE terminal, or by using the `give` web interface. Your file must be named `Ex01.hs` (case-sensitive!).

A dry-run test will *partially* autotest your solution at submission time. To get full marks, you will need to perform further testing yourself.