# 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.

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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.

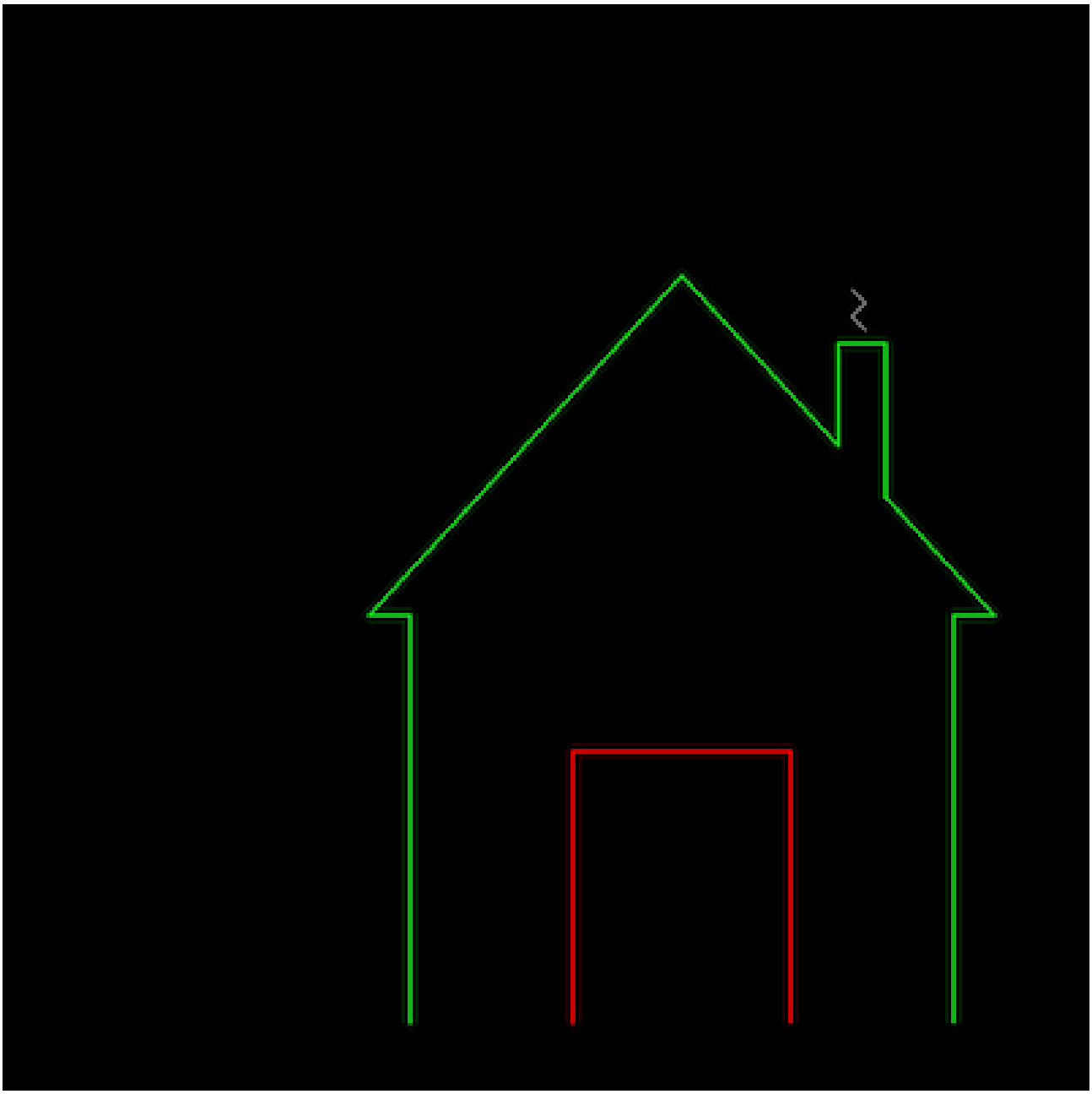
> Note that you will only need to submit `Ex01.hs`, so only make changes to that file.

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:

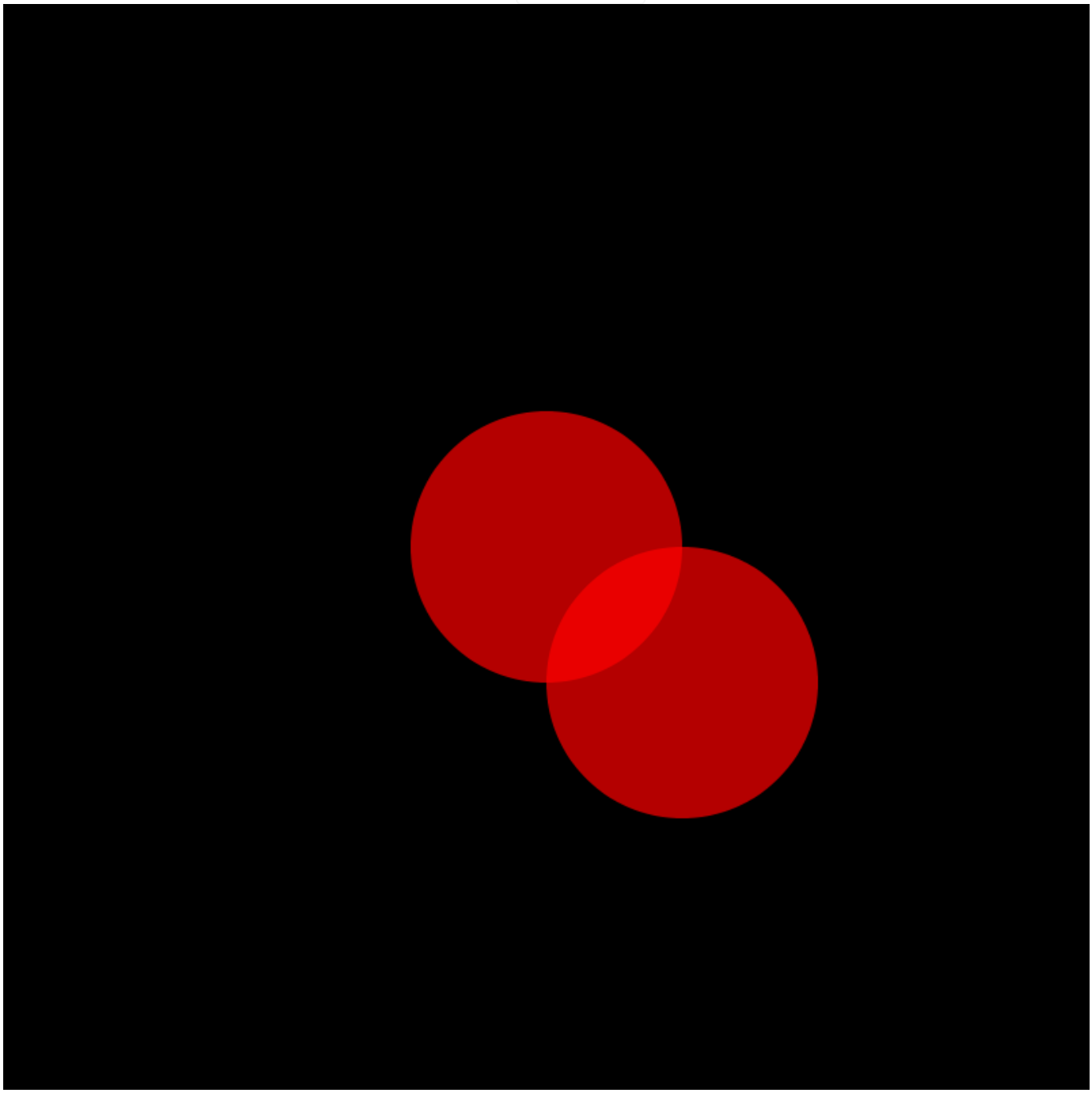
```
movePictureObject :: Vector -> PictureObject -> PictureObject
```

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`.

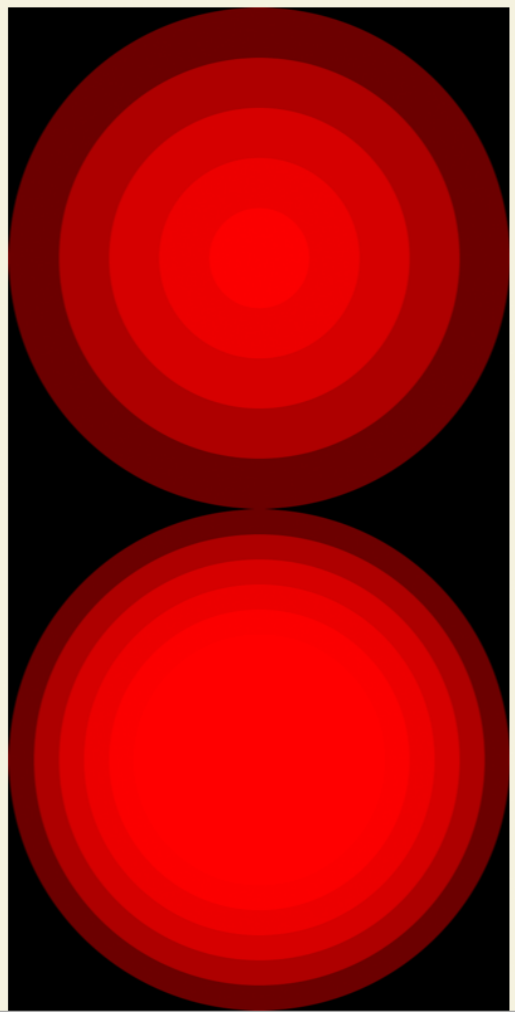
```
enumFromThenTo 1 3 10
enumFromThenTo 1 1.5 5


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.