mandelbrot-text

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1 COPYING

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```

2 hs/lib/Mandelbrot/Text/Glyph.hs

```
module Mandelbrot.Text.Glyph
  ( Glyph(..)
  ) where

5 data Glyph = Dot | Bra | Ket | Over | ArrowRight | Star
  deriving (Eq, Ord, Enum, Bounded, Read, Show)
```

3 hs/lib/Mandelbrot/Text.hs

```
module Mandelbrot.Text
  ( module Mandelbrot.Text.Glyph
  , module Mandelbrot.Text.HTML
  , module Mandelbrot.Text.LaTeX
5 , module Mandelbrot.Text.Parse
  , module Mandelbrot.Text.Plain
  ) where

import Mandelbrot.Text.Glyph
10 import Mandelbrot.Text.HTML
import Mandelbrot.Text.LaTeX
import Mandelbrot.Text.Parse
import Mandelbrot.Text.Plain
```

4 hs/lib/Mandelbrot/Text/HTML.hs

```
{-# LANGUAGE FlexibleInstances #-}
{-# LANGUAGE TypeSynonymInstances #-}
{- |
Pretty-printing in HTML.
5 -}
module Mandelbrot.Text.HTML
  ( HTML(..)
  ) where

10 import Prelude hiding
```

```
    ( Rational
    )
import qualified Data.Ratio as Ratio
import Data.List
  ( intercalate
  )

import Mandelbrot.Symbolics
  ( AngledAddress(..)
  , BinaryAngle(..)
  , ExternalAngle(..)
  , InternalAddress(..)
  , InternalAngle(..)
  , Kneading(..)
  , Periods(..)
  , Rational
  , numerator
  , denominator
  )

import Mandelbrot.Text.Glyph
  ( Glyph(..)
  )
import Mandelbrot.Text.Plain
  ( plain
  )

class HTML t where
  html :: t -> String

instance HTML Glyph where
  html Dot        = "<span class='m-dot'>" ++ plain Dot ++ "</span>"
  html Bra        = "<span class='m-bra'>" ++ plain Bra ++ "</span>"
  html Ket        = "<span class='m-ket'>" ++ plain Ket ++ "</span>"
  html Over       = "<span class='m-over'>" ++ plain Over ++ "</span>"
  html ArrowRight = "<span class='m-arrowright'>&#8594;</span>"
  html Star       = "<span class='m-star'>&#9733;</span>"

instance HTML AngledAddress where
  html aa = "<span class='m-angledaddress'>" ++ h aa ++ "</span>"
    where
      h (Unangled n) = "<span class='m-period'>" ++ show n ++ "</span>"
      h (Angled n r a)
        = "<span class='m-period'>"
        ++ show n
        ++ "</span><sub>"
        ++ html r
        ++ "</sub>"
        ++ html ArrowRight
        ++ h a

instance HTML BinaryAngle where
  html (BinaryAngle pre per)
    = "<span class='m-binaryangle'>"
    ++ html Dot
    ++ "<span class='m-preperiodic'>"
    ++ plain pre
```

```
      ++ "</span><span class='m-periodic'>"
      ++ plain per
      ++ "</span></span>"

instance HTML ExternalAngle where
  html (ExternalAngle r)
    = "<span class='m-externalangle'>" ++ html r ++ "</span>"

instance HTML InternalAddress where
  html (InternalAddress xs)
    = "<span class='m-internaladdress'>"
    ++ intercalate (html ArrowRight) (map h xs)
    ++ "</span>"
    where h x = "<span class='m-period'>" ++ show x ++ "</span>"

instance HTML InternalAngle where
  html (InternalAngle r)
    = "<span class='m-internalangle'>" ++ html r ++ "</span>"

instance HTML Kneading where
  html (PrePeriodic pre per)
    = "<span class='m-kneading'><span class='m-preperiodic'>"
    ++ plain pre
    ++ "</span><span class='m-periodic'>"
    ++ plain per
    ++ "</span></span>"
  html (StarPeriodic per)
    = "<span class='m-kneading'><span class='m-periodic'>"
    ++ plain per
    ++ html Star
    ++ "</span></span>"
  html (Periodic per)
    = "<span class='m-kneading'><span class='m-periodic'>"
    ++ plain per
    ++ "</span></span>"

instance HTML Periods where
  html (Periods (pp, p))
    | pp == 0 = "<span class='m-periods'><span class='m-p'>p</span>" ++
        "<span class='m-period'>" ++ show p ++ "</span></span>"
    | otherwise = "<span class='m-periods'><span class='m-preperiod'>" ++
        show pp ++ "</span><span class='m-p'>p</span><span class='m-period'>" ++
        show p ++ "</span></span>"

instance HTML Rational where
  html x
    = "<span class='m-rational'><span class='m-numerator'>"
    ++ show (numerator x)
    ++ "</span>"
    ++ html Over
    ++ "<span class='m-denominator'>"
    ++ show (denominator x)
    ++ "</span></span>"

instance HTML Ratio.Rational where
  html x
    = "<span class='m-rational'><span class='m-numerator'>"
```

```
      ++ show (numerator x)
      ++ "</span>"
      ++ html Over
      ++ "<span class='m-denominator'>"
      ++ show (denominator x)
      ++ "</span></span>"
```

5 hs/lib/Mandelbrot/Text/Latex.hs

```
{-# LANGUAGE FlexibleInstances #-}
{-# LANGUAGE TypeSynonymInstances #-}
{- |
Pretty-printing in LaTeX.
-}
module Mandelbrot.Text.LaTeX
  ( LaTeX(..)
  ) where

import Prelude hiding
  ( Rational
  )
import qualified Data.Ratio as Ratio
import Data.Complex
  ( Complex
  )
import Data.List
  ( intercalate
  )

import Mandelbrot.Symbolics
  ( AngledAddress(..)
  , Block
  , toList
  , BinaryAngle(..)
  , ExternalAngle(..)
  , InternalAddress(..)
  , InternalAngle(..)
  , Kneading(..)
  , Periods(..)
  , Rational
  , numerator
  , denominator
  )

import Mandelbrot.Text.Glyph
  ( Glyph(..)
  )
import Mandelbrot.Text.Plain
  ( plain
  )

class LaTeX t where
  latex :: t -> String

instance LaTeX Glyph where
  latex Dot         = "."
  latex Bra         = "\\left("
```

```
  latex Ket        = "\\right)"
  latex Over       = "/"
  latex ArrowRight = " \\to "
  latex Star       = " \\star "

instance LaTeX AngledAddress where
  latex (Unangled n) = show n
  latex (Angled n r a)
    = show n ++ "_{" ++ latex r ++ "}" ++ latex ArrowRight ++ latex a

instance LaTeX BinaryAngle where
  latex (BinaryAngle pre per)
    = latex Dot ++ plain pre ++ "\\overline{" ++ plain per ++ "}"

instance LaTeX ExternalAngle where
  latex (ExternalAngle r) = latex r

instance LaTeX InternalAddress where
  latex (InternalAddress xs)
    =  intercalate (latex ArrowRight) (map show xs)

instance LaTeX InternalAngle where
  latex (InternalAngle r) = latex r

instance LaTeX Kneading where
  latex (PrePeriodic pre per)
    = plain pre ++ "\\overline{" ++ plain per ++ "}"
  latex (StarPeriodic per)
    = "\\overline{" ++ plain per ++ latex Star ++ "}"
  latex (Periodic per)
    = "\\overline{" ++ plain per ++ "}"

instance LaTeX Periods where
  latex (Periods (pp, p))
    | pp == 0 = "\\mathbf{p}" ++ show p
    | otherwise = show pp ++ "\\mathbf{p}" ++ show p

instance LaTeX Rational where
  latex x
    = "\\frac{\\hfill " ++ show (numerator x) ++ "}{" ++ show (denominator x) ++↙
      ↳ "}"

instance LaTeX Ratio.Rational where
  latex x
    = "\\frac{\\hfill " ++ show (numerator x) ++ "}{" ++ show (denominator x) ++↙
      ↳ "}"

instance LaTeX Int where latex = show
instance LaTeX Integer where latex = show
instance LaTeX Double where latex = show

pprint :: Plain a => a -> IO ()
pprint = putStrLn . plain

appPrec :: Int
appPrec = 10
```

```
appPrec1 :: Int
appPrec1 = 11

instance Plain Char where
  plain = show
  plainList = showList

instance Plain Bool where plain = show
instance Plain Int where plain = show
instance Plain Integer where plain = show
instance Plain Double where plain = show
instance Plain (Complex Double) where plainPrec = showsPrec

instance Plain a => Plain (Maybe a) where
  plainPrec _ Nothing s = showString "Nothing" s
  plainPrec p (Just x) s =
    (showParen (p > appPrec) $
      showString "Just " .
      plainPrec appPrec1 x) s

instance Plain a => Plain [a] where
  plainPrec _ xs s = plainList xs s

instance (Plain a, Plain b) => Plain (Either a b) where
  plainPrec p (Left x) s =
    (showParen (p > appPrec) $
      showString "Left " .
      plainPrec appPrec1 x) s
  plainPrec p (Right x) s =
    (showParen (p > appPrec) $
      showString "Right " .
      plainPrec appPrec1 x) s

tuple :: [String->String] -> String->String
tuple ss = ('(':) . foldr1 (\s r -> s . (',':) . r) ss . (')':)

q :: Plain t => t -> String->String
q t s = plainPrec 0 t s

instance (Plain a, Plain b) => Plain (a,b) where
  plainPrec _ (a,b) s = tuple [q a, q b] s
instance (Plain a, Plain b, Plain c) => Plain (a,b,c) where
  plainPrec _ (a,b,c) s = tuple [q a, q b, q c] s
instance (Plain a, Plain b, Plain c, Plain d) => Plain (a,b,c,d) where
  plainPrec _ (a,b,c,d) s = tuple [q a, q b, q c, q d] s
instance (Plain a, Plain b, Plain c, Plain d, Plain e) => Plain (a,b,c,d,e) ↙
    ↳ where
  plainPrec _ (a,b,c,d,e) s = tuple [q a, q b, q c, q d, q e] s
```

6 hs/lib/Mandelbrot/Text/LaTeX.hs

```
{-# LANGUAGE FlexibleInstances #-}
{-# LANGUAGE TypeSynonymInstances #-}
{- |
Pretty-printing in LaTeX.
-}
module Mandelbrot.Text.LaTeX
```

```
    ( LaTeX(..)
    ) where

import Prelude hiding
    ( Rational
    )
import qualified Data.Ratio as Ratio
import Data.List
    ( intercalate
    )

import Mandelbrot.Symbolics
    ( AngledAddress(..)
    , BinaryAngle(..)
    , ExternalAngle(..)
    , InternalAddress(..)
    , InternalAngle(..)
    , Kneading(..)
    , Periods(..)
    , Rational
    , numerator
    , denominator
    )

import Mandelbrot.Text.Glyph
    ( Glyph(..)
    )
import Mandelbrot.Text.Plain
    ( plain
    )

class LaTeX t where
    latex :: t -> String

instance LaTeX Glyph where
    latex Dot        = "."
    latex Bra        = "\\left("
    latex Ket        = "\\right)"
    latex Over       = "/"
    latex ArrowRight = " \\to "
    latex Star       = " \\star "

instance LaTeX AngledAddress where
    latex (Unangled n) = show n
    latex (Angled n r a)
      = show n ++ "_{" ++ latex r ++ "}" ++ latex ArrowRight ++ latex a

instance LaTeX BinaryAngle where
    latex (BinaryAngle pre per)
      = latex Dot ++ plain pre ++ "\\overline{" ++ plain per ++ "}"

instance LaTeX ExternalAngle where
    latex (ExternalAngle r) = latex r

instance LaTeX InternalAddress where
    latex (InternalAddress xs)
      =  intercalate (latex ArrowRight) (map show xs)
```

```
instance LaTeX InternalAngle where
  latex (InternalAngle r) = latex r

instance LaTeX Kneading where
  latex (PrePeriodic pre per)
    = plain pre ++ "\\overline{" ++ plain per ++ "}"
  latex (StarPeriodic per)
    = "\\overline{" ++ plain per ++ latex Star ++ "}"
  latex (Periodic per)
    = "\\overline{" ++ plain per ++ "}"

instance LaTeX Periods where
  latex (Periods (pp, p))
    | pp == 0 = "\\mathbf{p}" ++ show p
    | otherwise = show pp ++ "\\mathbf{p}" ++ show p

instance LaTeX Rational where
  latex x
    = "\\frac{\\hfill " ++ show (numerator x) ++ "}{" ++ show (denominator x) ++↙
      ↳ "}"

instance LaTeX Ratio.Rational where
  latex x
    = "\\frac{\\hfill " ++ show (numerator x) ++ "}{" ++ show (denominator x) ++↙
      ↳ "}"

instance LaTeX Int where latex = show
instance LaTeX Integer where latex = show
instance LaTeX Double where latex = show
```

7 hs/lib/Mandelbrot/Text/Parse.hs

```
{-# LANGUAGE FlexibleInstances #-}
{-# LANGUAGE TypeSynonymInstances #-}
module Mandelbrot.Text.Parse
  ( Parser
  , Parse(..)
  ) where

import Prelude hiding
  ( Rational
  )

import Control.Monad
  ( guard
  )
import Control.Monad.Identity
  ( Identity()
  )
import Data.Char
  ( digitToInt
  )
import Data.List
  ( foldl'
  )
import Data.Maybe
```

```
    ( isJust
    , isNothing
    , catMaybes
    )
import Text.Parsec
    ( ParsecT()
    , choice
    , digit
    , many
    , many1
    , runParser
    , sepBy1
    , string
    , try
    , (<?>)
    )

import Mandelbrot.Symbolics
    ( AngledAddress(..)
    , Block()
    , compact
    , fromList
    , ExternalAngle(..)
    , BinaryAngle
    , binaryAngle
    , InternalAddress(..)
    , InternalAngle(..)
    , Kneading(..)
    , Periods(..)
    , Rational
    , (%)
    )

import Mandelbrot.Text.Glyph
    ( Glyph(..)
    )
import Mandelbrot.Text.Plain
    ( plain
    )

type Parser t = ParsecT String () Identity t

class Parse t where
  parser :: Parser t
  parse :: String -> Maybe t
  parse s = case runParser parser () "" s of
    Left _ -> Nothing
    Right t -> Just t

instance Parse AngledAddress where
  parser = choice [ try angled, unangled ] <?> "angled address"
    where
      unangled = Unangled `fmap` parser <?> "period"
      angled = do
        n <- parser <?> "period"
        _ <- string "_"
        r <- parser
```

```
        _ <- string (plain ArrowRight)
        a <- parser
        return $ Angled n r a

instance Parse BinaryAngle where
  parser = do
    _ <- string (plain Dot)
    pre <- parser <?> "preperiodic bits"
    _ <- string (plain Bra)
    per <- parser <?> "periodic bits"
    _ <- string (plain Ket)
    return $ binaryAngle pre per

instance Parse Block where
  parser = fromList `fmap` many bit <?> "bits"

bit :: Parser Bool
bit = choice
  [ string "0" >> return False
  , string "1" >> return True
  ] <?> "bit"

instance Parse ExternalAngle where
  parser = ExternalAngle `fmap` parser <?> "external angle"

instance Parse Int where
  parser = base10 `fmap` map digitToInt `fmap` many1 digit <?> "int"

instance Parse Integer where
  parser = base10 `fmap` map (toInteger . digitToInt) `fmap` many1 digit <?> "integer"

base10 :: Num a => [a] -> a
base10 = foldl' (\x y -> 10 * x + y) 0

instance Parse InternalAddress where
  parser = InternalAddress `fmap` sepBy1 (parser <?> "period") (string (plain ArrowRight)) <?> "internal address"

instance Parse InternalAngle where
  parser = InternalAngle `fmap` parser <?> "internal angle"

instance Parse Kneading where
  parser = do
    pre <- many knead <?> "kneading preperiodic part"
    per <- do
      _ <- string (plain Bra)
      per' <- many1 knead <?> "kneading periodic part"
      _ <- string (plain Ket)
      return per'
    case () of
      _ | null pre &&
          all isJust per -> return . Periodic . compact . fromList . catMaybes $ per
        | null pre &&
          all isJust (init per) &&
          isNothing (last per) -> return . StarPeriodic . fromList . catMaybes $
```

```
            ↳ per
        | all isJust pre &&
          all isJust per -> return $ PrePeriodic (fromList . catMaybes $ pre) (↙
            ↳ compact . fromList . catMaybes $ per)  -- FIXME might not be ↙
            ↳ canonical?
      _ -> fail "invalid kneading sequence"

knead :: Parser (Maybe Bool)
knead = choice
  [ string "0" >> return (Just False)
  , string "1" >> return (Just True)
  , string (plain Star) >> return Nothing
  ] <?> "kneading item"

instance Parse Periods where
  parser = do
    pp <- base10 `fmap` map digitToInt `fmap` many digit <?> "preperiod"
    _ <- string "p"
    p <- base10 `fmap` map digitToInt `fmap` many1 digit <?> "period"
    guard (pp >= 0)
    guard (p >= 1)
    return $ Periods (pp, p)

instance Parse Rational where
  parser = (do
    n <- parser <?> "numerator"
    _ <- string (plain Over)
    d <- parser <?> "denominator"
    guard (d /= 0)
    return $ n % d) <?> "rational"

{-
parser' :: Parse AngledInternalAddress
parser' = do
  ts <- pTokens
  accum 1 ts
  where
    accum p [] = return $ Unangled (fromIntegral p)
    accum _ [Number n] = return $ Unangled (fromIntegral n)
    accum _ (Number n : ts@(Number _ : _)) = do
      a <- accum n ts
      return $ Angled (fromIntegral n) (1%2) a
    accum _ (Number n : Fraction t b : ts) = do
      a <- accum (n * b) ts
      return $ Angled (fromIntegral n) (t%b) a
    accum p (Fraction t b : ts) = do
      a <- accum (p * b) ts
      return $ Angled (fromIntegral p) (t % b) a
-}
```

8 hs/lib/Mandelbrot/Text/Plain.hs

```
{-# LANGUAGE FlexibleInstances #-}
{-# LANGUAGE TypeSynonymInstances #-}
{- |
Pretty-printing in plain text.
-}
```

```
module Mandelbrot.Text.Plain
  ( Plain(..)
  , pprint
  ) where

import Prelude hiding
  ( Rational
  )
import qualified Data.Ratio as Ratio
import Data.Complex
  ( Complex
  )
import Data.List
  ( intercalate
  )

import Mandelbrot.Symbolics
  ( AngledAddress(..)
  , Block
  , toList
  , BinaryAngle(..)
  , ExternalAngle(..)
  , InternalAddress(..)
  , InternalAngle(..)
  , Kneading(..)
  , Periods(..)
  , Rational
  , numerator
  , denominator
  )

import Mandelbrot.Text.Glyph
  ( Glyph(..)
  )

class Plain t where
  plain :: t -> String
  plain x = plainPrec 0 x ""
  plainPrec :: Int -> t -> String -> String
  plainPrec _ x s = plain x ++ s
  plainList :: [t] -> String -> String
  plainList xs s = "[" ++ intercalate "," (map plain xs) ++ "]" ++ s

instance Plain Glyph where
  plain Dot        = "."
  plain Bra        = "("
  plain Ket        = ")"
  plain Over       = "/"
  plain ArrowRight = "->" -- "\8594"
  plain Star       = "*"  -- "\9733"

instance Plain AngledAddress where
  plain (Unangled n) = show n
  plain (Angled n r a) = show n ++ "_" ++ plain r ++ plain ArrowRight ++ plain a

instance Plain BinaryAngle where
  plain (BinaryAngle pre per)
```

```
    = plain Dot ++ plain pre ++ plain Bra ++ plain per ++ plain Ket

instance Plain Block where
  plain = map bit . toList
    where
      bit False = '0'
      bit True  = '1'

instance Plain ExternalAngle where
  plain (ExternalAngle r) = plain r

instance Plain InternalAddress where
  plain (InternalAddress xs) = intercalate (plain ArrowRight) (map show xs)

instance Plain InternalAngle where
  plain (InternalAngle r) = plain r

instance Plain Kneading where
  plain (PrePeriodic pre per) = plain pre ++ plain Bra ++ plain per ++ plain Ket
  plain (StarPeriodic per) = plain Bra ++ plain per ++ plain Star ++ plain Ket
  plain (Periodic per) = plain Bra ++ plain per ++ plain Ket

instance Plain Periods where
  plain (Periods (pp, p))
    | pp == 0 = "p" ++ show p
    | otherwise = show pp ++ "p" ++ show p

instance Plain Rational where
  plain x = show (numerator x) ++ plain Over ++ show (denominator x)

instance Plain Ratio.Rational where
  plain x = show (numerator x) ++ plain Over ++ show (denominator x)

appPrec :: Int
appPrec = 10

appPrec1 :: Int
appPrec1 = 11

instance Plain Char where
  plain = show
  plainList = showList

instance Plain Bool where plain = show
instance Plain Int where plain = show
instance Plain Integer where plain = show
instance Plain Double where plain = show
instance Plain (Complex Double) where plainPrec = showsPrec

instance Plain a => Plain (Maybe a) where
  plainPrec _ Nothing s = showString "Nothing" s
  plainPrec p (Just x) s =
    (showParen (p > appPrec) $
      showString "Just " .
      plainPrec appPrec1 x) s

instance Plain a => Plain [a] where
```

```
120     plainPrec _ xs s = plainList xs s

      instance (Plain a, Plain b) => Plain (Either a b) where
        plainPrec p (Left x) s =
          (showParen (p > appPrec) $
            showString "Left " .
            plainPrec appPrec1 x) s
        plainPrec p (Right x) s =
          (showParen (p > appPrec) $
            showString "Right " .
            plainPrec appPrec1 x) s

      tuple :: [String->String] -> String->String
      tuple ss = ('(':) . foldr1 (\s r -> s . (',':) . r) ss . (')':)

      q :: Plain t => t -> String->String
      q t s = plainPrec 0 t s

      instance (Plain a, Plain b) => Plain (a,b) where
        plainPrec _ (a,b) s = tuple [q a, q b] s
      instance (Plain a, Plain b, Plain c) => Plain (a,b,c) where
        plainPrec _ (a,b,c) s = tuple [q a, q b, q c] s
      instance (Plain a, Plain b, Plain c, Plain d) => Plain (a,b,c,d) where
        plainPrec _ (a,b,c,d) s = tuple [q a, q b, q c, q d] s
      instance (Plain a, Plain b, Plain c, Plain d, Plain e) => Plain (a,b,c,d,e) ↙
          ↳ where
        plainPrec _ (a,b,c,d,e) s = tuple [q a, q b, q c, q d, q e] s

      pprint :: Plain a => a -> IO ()
      pprint = putStrLn . plain
```

9 mandelbrot-text.cabal

```
      name:                mandelbrot-text
      version:             0.1.0.0
      synopsis:            parsing and pretty printing related to the Mandelbrot set
      description:         Parsing and pretty printing related to the Mandelbrot set.
 5    homepage:            https://code.mathr.co.uk/mandelbrot-text
      license:             GPL-3
      license-file:        COPYING
      author:              Claude Heiland-Allen
      maintainer:          claude@mathr.co.uk
10    copyright:           (c) 2019 Claude Heiland-Allen
      category:            Math
      build-type:          Simple
      cabal-version:       >=1.10
      extra-source-files:
15      README.md

      library
        exposed-modules:
          Mandelbrot.Text,
20        Mandelbrot.Text.Glyph,
          Mandelbrot.Text.HTML,
          Mandelbrot.Text.LaTeX,
          Mandelbrot.Text.Parse,
          Mandelbrot.Text.Plain
```

```
    other-extensions:
      FlexibleInstances,
      TypeSynonymInstances
    build-depends:
      base    >=4.7 && <4.14,
      mtl     >=2.1 && <2.3,
      parsec  >=3.1 && <3.2,
      strict  >=0.3 && <0.4,
      mandelbrot-symbolics >=0.1 && <0.2
    hs-source-dirs:       hs/lib
    default-language:     Haskell2010
    ghc-options:          -Wall
    ghc-prof-options:     -prof -auto-all -caf-all

source-repository head
  type:     git
  location: https://code.mathr.co.uk/mandelbrot-text.git

source-repository this
  type:     git
  location: https://code.mathr.co.uk/mandelbrot-text.git
  tag:      v0.1.0.0
```

10 README.md

```
mandelbrot-text
===============

Parsing and pretty printing related to the Mandelbrot set.
```

11 Setup.hs

```
import Distribution.Simple
main = defaultMain
```