

# Haskore

Henri Lakk

# *Sissejuhatus*

- Haskore on Haskell'i moodulite kogum, mis võimaldab kirjeldada muusika objekte funktsionaalprogrammeerimise deklaratiiivses stiilis.
- Mõeldud (lääne) muusika loomiseks
  - Ei sobi helide genereerimiseks.
- Võimalik tõestada muusikaliste objektide omadusi.

# *Muusika objektid*

- Noodid
- Pausid
- Muusika objektide transformeerimine
  - Helikõrguse muurmine
  - Tempo muutmine
- Muusika objektide kombineerimine
  - Järjestiku
  - Paralleelselt

# *Helikõrgus (pitch)*

```
type Pitch          = (PitchClass, Octave)
```

```
data PitchClass = Cf | C | Cs | Df | D | Ds  
               | Ef | E | Es | Ff | F | Fs  
               | Gf | G | Gs | Af | A | As  
               | Bf | B | Bs  
    deriving (Eq, Ord, Ix, Show)
```

```
type Octave         = Int
```

- Kokkuleppeliselt A440 = (A,4)

# *Muusika*

```
Infixr 5 :+:, :=:
```

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```
data Music = Note Pitch Dur [NoteAttribute]
                                -- a note \ atomic
                | Rest Dur      -- a rest / objects
                | Music :+: Music -- sequential composition
                | Music :=: Music -- parallel composition
                | Tempo  Int Int Music -- scale the tempo
                | Trans  Int Music    -- transposition
                | Instr  IName Music  -- instrument label
                | Player PName Music  -- player label
                | Phrase [PhraseAttribute] Music
                                -- phrase attributes
```

```
deriving Show
```

```
type Dur    = Float           -- in whole notes
type IName  = String
type PName  = String
```

# *Noodid (I)*

cf,c,cs,df,d,ds,ef,e,es,ff,f,fs,gf,g,gs,af,a,as,bf,b,bs ::  
Octave -> Dur -> [NoteAttribute] -> Music

|                     |                   |                    |
|---------------------|-------------------|--------------------|
| cf o = Note (Cf,o); | c o = Note (C,o); | cs o = Note (Cs,o) |
| df o = Note (Df,o); | d o = Note (D,o); | ds o = Note (Ds,o) |
| ef o = Note (Ef,o); | e o = Note (E,o); | es o = Note (Es,o) |
| ff o = Note (Ff,o); | f o = Note (F,o); | fs o = Note (Fs,o) |
| gf o = Note (Gf,o); | g o = Note (G,o); | gs o = Note (Gs,o) |
| af o = Note (Af,o); | a o = Note (A,o); | as o = Note (As,o) |
| bf o = Note (Bf,o); | b o = Note (B,o); | bs o = Note (Bs,o) |

## *Noodid (II)*

```
wn,  hn,  qn,  en,  sn,  tn  :: Dur
wnr, hnr, qnr, enr, snr, tnr :: Music
```

```
wn = 1           ; wnr = Rest wn -- whole note rest
hn = 1/2         ; hnr = Rest hn -- half note rest
qn = 1/4         ; qnr = Rest qn -- quarter note rest
en = 1/8         ; enr = Rest en -- eight note rest
sn = 1/16        ; snr = Rest sn -- sixteenth note rest
tn = 1/32        ; tnr = Rest tn -- thirty-second note rest
```

# *line ja chord*

```
line, chord :: [Music] -> Music
line  = foldr (:+:) (Rest 0)
chord = foldr (:=:) (Rest 0)
```

```
cMaj = map (\f->f 4 qn []) [c, e, g]
                                -- octave 4, quarter notes
```

```
cMajArp = line  cMaj
cMajChd  = chord cMaj
```

# *changeTempo ja transpose*

```
changeTempo :: DurRatio -> Music -> Music
```

```
transpose :: Pitch -> Music -> Music
```

# *MIDI*

- **Haskore.Interface.MIDI.Render:**

```
fileFromGeneralMIDIMusic :: FilePath -> T -> IO ()
```

```
playTimidity :: T -> IO ()
```

- **Haskore.Music.GeneralMIDI:**

```
fromStdMelody :: Instr -> T -> T
```

# *Moodulid*

module Haskore.Music

module Haskore.Performance

module Haskore.Performance.Player

module Haskore.Interface.MIDI.Write

module Haskore.Interface.MIDI.Read

module Sound.MIDI.File.Save

module Sound.MIDI.File.Load

module Haskore.Interface.MIDI.Render

# Väljundid

- MIDI (*Musical Instrument Digital Interface*) – reaalaajas ja faili kirjutamine
- CSound – Muusika, heli ja signaali töötlemise süsteem
- SuperCollider – reaalaajas töötav tarkvaraline süntesaator
- Synthesizer - audio failid, mida on renderdatud puhtas Haskell'i koodis
- Muusika notatsiooni väljundid puuduvad

# *Paigaldamine*

- Paigaldamiseks vajalik Haskell'i parseri generaatorit *Happy*
- `$ ./cabal install haskore`
  - Kompileerimisel palju hoiatusi

*Demo*

# *Viited*

- Haskore dokumentatsioon ( <http://hackage.haskell.org/packages/archive/hasl> ) (20.05.2009)
- Paul Hudak, Haskore Music Tutorial, 1997 ( <http://www.haskell.org/haskore/onlinetutorial/in> ) (20.05.2009)
- The Haskore Computer Music System ( <http://www.haskell.org/haskore/> ) (20.05.2009)

*Küsimused*

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