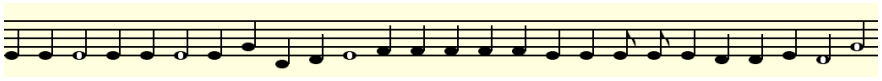
A2 [WORKSHEET: ML COMPILER]

We want to create nice looking sheet of music in the language SVG to visualize our songs written in ML.

Example for Jingle Bells:



To make this task a little bit easier, we limit the sheet of music to a single stave. There are no bar lines or lines from one note to another.

In VCC we can define the S attribute at starting rule Song → Notes as following (use copy&paste to load in your project):

```
$$ = "<?xml version=\"1.0\" ?>\r\n";
$$ += "<!DOCTYPE svg PUBLIC \"-//W3C//DTD SVG 20010904//EN\" \"http://www.w3.org/TR/2001/REC-SVG-
20010904/DTD/svg10.dtd\">\r\n";
$$ += "<svg width=\"1200\" height=\"100\" xmlns=\"http://www.w3.org/2000/svg\"
xmlns:xlink=\"http://www.w3.org/1999/xlink\">\r\n";
$$ += " <rect x=\"0\" y=\"0\" width=\"1200\" height=\"100\" fill=\"lightyellow\" />\r\n";
$$ += "   <line x1=\"0\" y1=\"30\" x2=\"1200\" y2=\"30\" style=\"stroke:black;stroke-width:2\"/>\r\n";
$$ += "   <line x1=\"0\" y1=\"40\" x2=\"1200\" y2=\"40\" style=\"stroke:black;stroke-width:2\"/>\r\n";
$$ += "   <line x1=\"0\" y1=\"50\" x2=\"1200\" y2=\"50\" style=\"stroke:black;stroke-width:2\"/>\r\n";
$$ += "   <line x1=\"0\" y1=\"60\" x2=\"1200\" y2=\"60\" style=\"stroke:black;stroke-width:2\"/>\r\n";
$$ += "   <line x1=\"0\" y1=\"70\" x2=\"1200\" y2=\"70\" style=\"stroke:black;stroke-width:2\"/>\r\n";
$$ += "   <g transform=\"scale(0.3), translate(-30,5)\">\r\n";
$$ += "     <path style=\"fill:black;fill-opacity:1;fill-rule:nonzero;stroke:none;stroke-width:1px;stroke-linecap:butt;stroke-
linejoin:miter;stroke-opacity:1\"\r\n";
$$ += "          d=\"M 69.5,269 C 109.49865,237.74085 32.262361,224.08824 56,272 C 61.182004,282.45929 111.5,308.5147 111.5,232
C 111.5,174.5";
$$ += "          76.5,101.5 76.5,72.5 C 76.5,43.5 99.5,28 99.5,66.5 C 99.5,105 43,138 43,178 C 43,244.03444 133.5,245.03362
133.5,196";
$$ += "          C 133.5,150.49725 91.173308,149.09646 77.5,160.5 C 57.985811,176.77483 65.057032,208.40019 88,210.5 C
54.34356,167.39365";
$$ += "          119.69526,156.08817 124,192.5 C 128.73256,232.53051 54.5,233.66467 54.5,185 C 54.5,146.5
115.77186,107.39877 113,69.5";
$$ += "          C 109,14.809305 73.139128,-2.0985557 69,64.5 C 66.090245,110.81795 103.83053,169.51937 105.5,235 C
106.56602,276.81169";
$$ += "          75.181981,287.85355 69.5,269 z \"/>\r\n";
$$ += "   </g>\r\n";
$$ += "<line x1=\"40\" y1=\"30\" x2=\"40\" y2=\"70\" style=\"stroke:black;stroke-width:2\" />\r\n";

$$ += $1+"\r\n";

$$ += "</svg>";

Output.WriteLine($$);
```

This will generate the SVG header, a single stave with 5 lines and already defines a background color and picture size. The lines are drawn at y=30, y=40, y=50, y=60 and y=70. The note C0 has a y value of 80 and for F0 its 65.

A single note we can display as an ellipse in SVG:
<ellipse cx="20" cy="65" rx="8" ry="5" style="fill:black;"/>

You need to define the values cx and cy as center of the ellipse. The other two values rx and ry are used to determine the size (no need to change them).
For full notes and half notes we can draw a little white ellipse inside the first one:
<ellipse cx="20" cy="65" rx="3" ry="4" style="fill:white;"/>

A note stem we can create with a line (about 30 units long):
<line x1="28" y1="65" x2="28" y2="35"
style="stroke:black; stroke-width:2" />

The little attachments for 1/8 and 1/16 notes we can add by using this path (you need to define the starting positions 20,35 only):
<path d="M 20,35 q 0,10 5,10 t 5,10" style="stroke:black;" />

Tasks:

» ***Develop a compiler for ML → SVG.***

» *Define a new T-Diagram for ML→SVG, including FireFox as SVG interpreter.*

» *Save your ML interpreter under a new file name in VCC!!!*

» *We use $$ and $n placeholders to produce the target SVG code. There is no direct Output (like System.out.println)!*

» *Make sure all your S attributes are defined and return a result $$.*

» *Generate SVG code especially in the rule: Note → Key - Duration*

» *Use a global variable for determine each note position x. (With each note x is incremented by 40 for example.)*

» *Test your compiler in TDiag with multiple input files.*