

1. Create a NetLogo model. In your model create 16, 32, 48 or 64 turtles by using a SLIDER. Have the "odd" turtles take 5 steps forward. Have the "even" turtles take 10 steps forward. Save your NetLogo model and send it to jacobson@cs.uni.edu as an attachment. *You certainly may add additional features to this, if you wish. For example, you might want the turtles to do a dance or change colors or spiral a circle of squares after they get out to their destination. You could have the turtles leave a trail by having their pens down using PD and PU. The main idea is doing something different with the EVEN and the ODD turtles.*

remainder

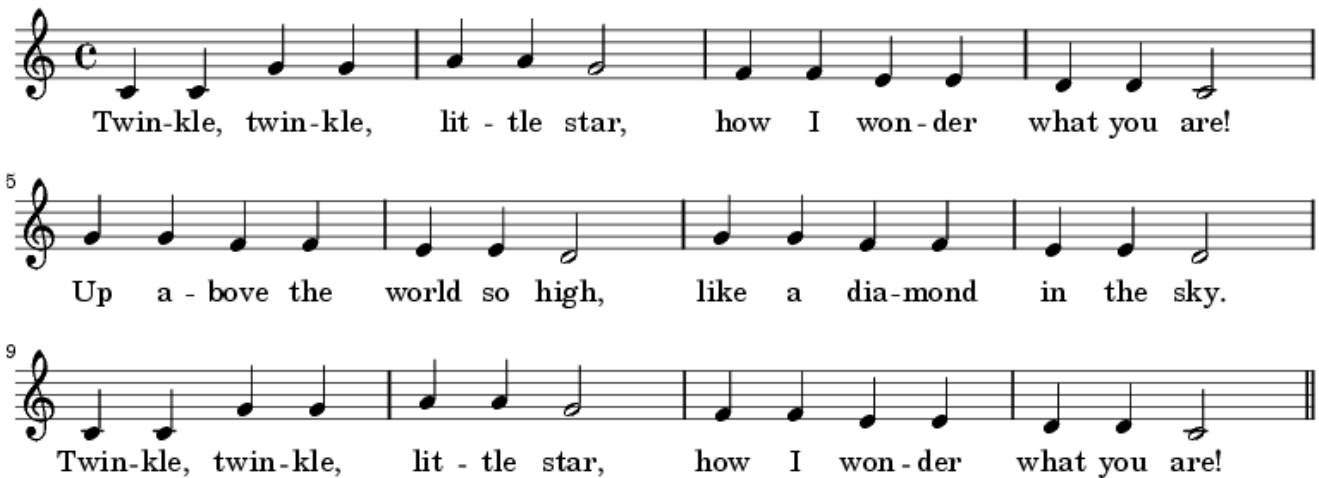
remainder *number1 number2*

Reports the remainder when *number1* is divided by *number2*. This is equivalent to the following NetLogo code:

```
number1 - (int (number1 / number2)) * number2
```

```
show remainder 62 5
=> 2
show remainder -8 3
=> -2
```

2. In the NetLogo models library, open File->Models Library; Sample Models -> Chemistry & Physics -> GasLab -> GasLab Maxwells Demon.
 - Click on the Information tab and read the sections on "**What is it?**" and "**How it works.**" Answer these questions.
 - Who is "Maxwell's Demon," and what does the demon do?
 - How does the model detect when two balls "hit" each other?
 - Click on the Interface tab. Change the number of particles to 500, click "setup," and then click on "go."
 - In the middle interface, balls with numbers appear. What do these represent?
 - What does the color of the balls represent?
 - The balls are not always the same color as when the simulation started out. What makes them change their color?
 - Describe what happens when your models is allowed to run over a long period of time (you may want to increase the speed).
3. Create the NetLogo model that will play the song **Twinkle Twinkle Little Star** once when the user of your model clicks a button. Give the user choices for the length of a quarter note in the song to be any of the following: 0.1, 0.2, 0.3, 0.4, 0.5 or 0.6 for the various TEMPO choices. Send the NetLogo model file as an attachment to jacobson@cs.uni.edu on or before the due date deadline. Use any musical instrument that you like.



Using the list approach (using a **foreach** statement with two lists, one for note, one for duration of the note) is encouraged, but not required. See the <http://www.cs.uni.edu/~jacobson/025/logo/bday.html> page for more details. And use the 01/12/2012 first day class handouts.

Much improved use of NetLogo to "sing" Happy Birthday

```
extensions [sound]

to playHappyBirthday
  ( foreach [ 60 60 62 60 65 64      60 60 62 60 67 65      60 60 72 69 65 64 62      70 70 69 65 67 65 ]
    [ .3 .1 .4 .4 .4 .8      .3 .1 .4 .4 .4 .8      .3 .1 .4 .4 .4 .4 .4      .3 .1 .4 .4 .4 .8 ]
    [
      playNote ?1 ?2
    ]
  )
end

to playNote [ theNote theLength ]

  sound:start-note "TRUMPET" theNote 65
  wait theLength
  sound:stop-note "TRUMPET" theNote
end
```

Note that the Twinkle Twinkle Little Star song has only quarter notes and half notes. A quarter note gets 1 count and a half note gets two counts. There are 36 quarter notes in the song and 6 half notes in the song. $32 \text{ plus } 2 \text{ times } 6 = 48 \text{ counts or } 48 \text{ beats}$ in the song.

```
extensions [sound]

to playScale
  ( foreach [ 60 62 64 64 65 67 69 71 71 72 60      64 67 72 ]
    [ 1 1 .5 .5 1 1 1 .5 .5 1 2      1 1 4 ]
    [
      playNote ?1 ?2
    ]
  )
end

to playNote [ theNote theLength ]

  sound:start-note "TRUMPET" theNote 65
  wait theLength * quarterNoteLength
  sound:stop-note "TRUMPET" theNote
end
```

