

**Problem:** Suppose a zombie population initially has two members. Every 15 minutes, the population doubles. If we let one unit of time be 10 minutes, what is a recursion equation for the population at time  $t$ ?

**Solution:** We want an equation of the form

$$N_{t+1} = RN_t.$$

The main difficulty is that we have information in terms of 15 minute intervals, but we want to express things in terms of 10 minute intervals.

Let

$s$  = number of 15 minute intervals

$t$  = number of 10 minute intervals.

For  $s$ , we can express the equation as  $N_{s+1} = 2N_s$ .

But we want  $t$ , so we need to find  $R$ . Since the amount of time passed is the same regardless of our block size, we have

$$(15\text{minutes})(\text{number of 15 minute intervals}) = \text{TIME} = (10\text{minutes})(\text{number of 10 minute intervals}),$$

so this gives you

$$15s = 10t.$$

You solve this as  $s = \frac{2}{3}t$ .

Now, when  $s$  and  $t$  represent the same amount of time, we have done  $s$  multiplications by 2 and  $t$  multiplications by  $R$  on the initial population size.

Therefore

$$2^s = R^t.$$

Since  $s = \frac{2}{3}t$ , this gives us

$$2^{\frac{2}{3}t} = R^t.$$

Taking logarithms gives us that  $R = 2^{\frac{2}{3}}$ .

So we write  $N_{t+1} = 2^{\frac{2}{3}}N_t$ , and we've solved the problem.