Aaron Nelson Hwrk 1

1. Hastings Chapter 2: problem #1

$$\frac{\ln[N(t)/N(0)]}{r} = t$$

for 100 lice → $\frac{\ln[100/10]\ \text{lice}}{0.1\ \text{lice/day}} = 23$ days

for 1000 lice $\frac{\ln[1000/10]\ \text{lice}}{0.1\ \text{lice/day}} = 46$ days

for 100,000,000 $\frac{\ln[100,000,000/10]\ \text{lice}}{0.1\ \text{lice/day}} = 138$ days

for 100,000,000,000 $\frac{\ln[100,000,000,000/10]\ \text{lice}}{0.1\ \text{lice/day}} = 184$ days

I'm a little surprised, but by looking at a graph of $\ln x = f(x)$, I'm reminded that $\ln(x)$ becomes exponentially larger as $f(x)$ increases.

2. $N(t) = N(0)e^{rt}$ | $N(t) = N(50) = 2$, $N(0) = 1$, $t = 50$ } population doubles

$2 = (1)e^{r(50\ \text{yrs})}$

$\ln 2 = \ln e^{r(50\ \text{yrs})}$

$\ln 2 = r(50\ \text{yrs})$

$\frac{\ln 2}{50\ \text{yrs}} = r = .014/\text{year}$

3. Use discrete time.

$N_t = N_0 \lambda^t$; $\lambda = r + 1 = 0.12 + 1 = 1.12$

let $N_t = 2$ and $N_0 = 1$

$\rightarrow 2 = (1)\, 1.12^t$

$\ln 2 = \ln (1.12^t)$

$\ln 2 = t \ln (1.12)$

$\frac{\ln 2}{\ln (1.12)} = t$ = **6.11 years vs doubling time**

4. Most causes of death are related to aging and general health problems, (e.g. Heart disease, cancer, respiratory diseases, etc.) which aren't caused by population pressures, so the death rate is density-independent.

3 factors that introduce density dependence:

1. More people/area = more cars/area = higher likelyhood of car accident mortalities
2. Also, higher population densities will have higher concentrations of pollution, which will shorten lifespans.
3. The "pace of life" tends to increase in cities vs. rural areas, which may cause more stress, which may shorten lifespans.

5. The marbled murrelet (*Brachyramphus marmoratus*) is a seabird that nests in coastal old-growth trees of the Pacific Northwest.

It's population growth is discrete because mating pairs only produce one brood per year during the spring mating season. Each brood contains only one egg as well. They are Federally endangered.