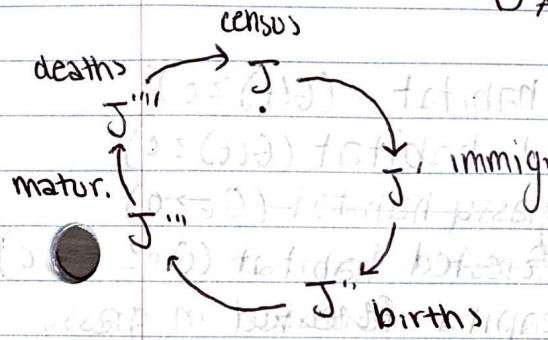
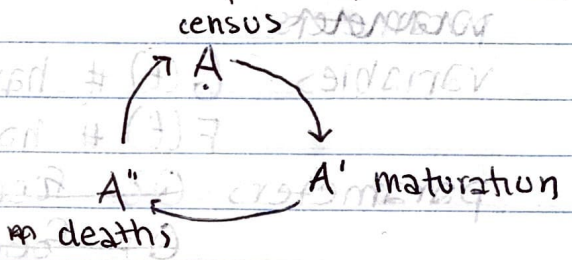
Q2:

A1: how does # juvenile and adult mice in a population change over time?

variables: J : # juvenile mice in a population ($J \geq 0$)
A : # adult mice in a population ($A \geq 0$)

parameters: I: immigration as # of J mice ($M \geq 0$) per year
B : births per capita A ($B \geq 0$) per year
M: maturation as per capita J ($M \geq 0$) $\frac{\text{per}}{\text{yr}}$
D_J deaths of juveniles per capita J $\frac{\text{per yr}}{(D_J \geq 0)}$
D_A deaths of adults per capita A $\frac{\text{per yr}}{(D_A \geq 0)}$





$J' = J(t) + I$ ↗ original Adult pop b/c maturation hasn't occured

$J'' = J' + B \cdot A(t)$

$J''' = J'' - M \cdot J''$

$J'''' = J''' - D_J \cdot J'''$

substitute:

$J'' = J(t) + I + B \cdot A(t)$

$J''' = J(t) + I + B \cdot A(t) - M \cdot (J(t) + I + B \cdot A(t))$

$= (J(t) + I + B \cdot A(t)) \cdot (1 - M)$

$J'''' = (J(t) + I + B \cdot A(t)) \cdot (1 - M) - D_J \cdot (J(t) + I + B \cdot A(t)) \cdot (1 - M)$

$J(t+1) = (J(t) + I + B \cdot A(t)) \cdot (1 - M) \cdot (1 - D_J)$

pop of juveniles after immigration and births

$A' = A(t) + M \cdot J''$

$A'' = A' - D_A \cdot A'$

substitute

$A' = A(t) + M \cdot (J(t) + I + B \cdot A(t))$

$A'' = A(t) + M \cdot (J(t) + I + B \cdot A(t)) - D_A (A(t) + M \cdot (J(t) + I + B \cdot A(t))$

$A(t+1) = (A(t) + M \cdot (J(t) + I + B \cdot A(t)) \cdot (1 - D_A)$

A.2: how does the number of snowshoe hare found in one of two habitats types change over time?

~~parameters~~:

variables: $G(t)$ # hares in grassy habitat $(G(t) \geq 0)$

$F(t)$ # hares in forested habitat $(G(t) \geq 0)$

parameters: ~~Q_G: food quality in grassy habitat $(Q_G \geq 0)$~~

~~Q_F: food quality in forested habitat $(Q_F \geq 0)$~~

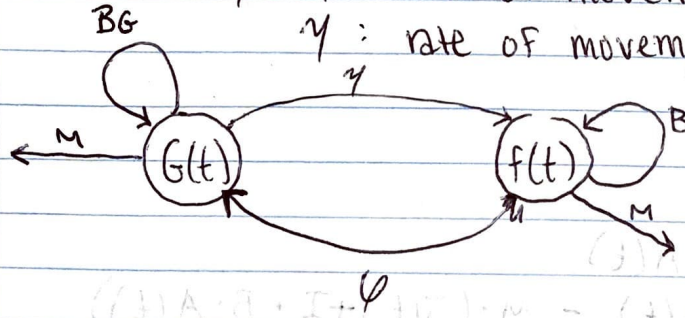
B_G: birth rate per capita ~~forested~~ in grassy

B_F: birth rate per capita in forested $(B \geq 0)$

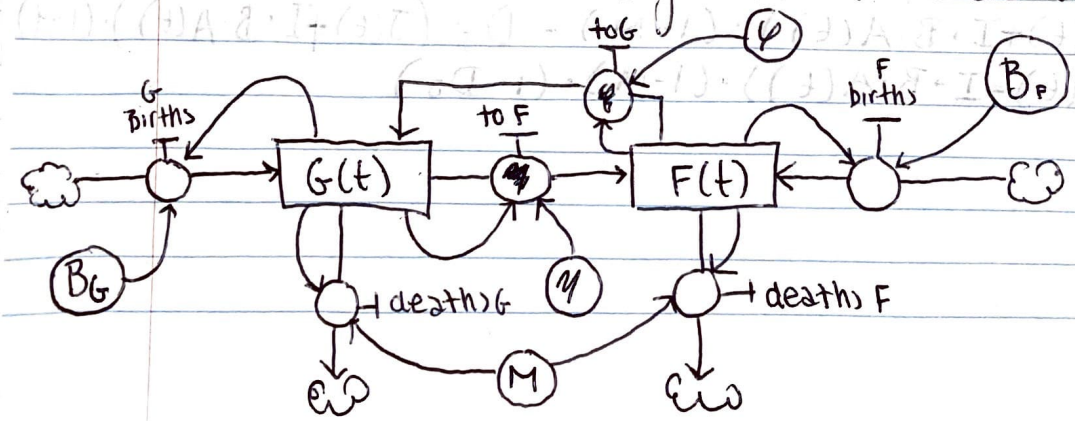
M: mortality rate per capita $(M \geq 0)$

φ ~~γ~~: rate of movement to grassy per capita $(\varphi \geq 0)$

γ: rate of movement to forested per capita $(\gamma \geq 0)$



* I learned different diagrams: squares are variables, circles are parameters, ← are flows, ☁ out of system



$$\frac{dG(t)}{dt} = \text{increases} - \text{losses}$$

$$= B_G \cdot G(t) + \emptyset \cdot F(t) - \left(M \cdot G(t) + \gamma \cdot G(t)\right)$$

$$\frac{dF(t)}{dt} = \text{increases} - \text{losses}$$

$$= B_F \cdot F(t) + \gamma \cdot F(t) - \left(M \cdot F(t) + \emptyset \cdot F(t)\right)$$