Modeling Hipster Populations

PROBLEM: A

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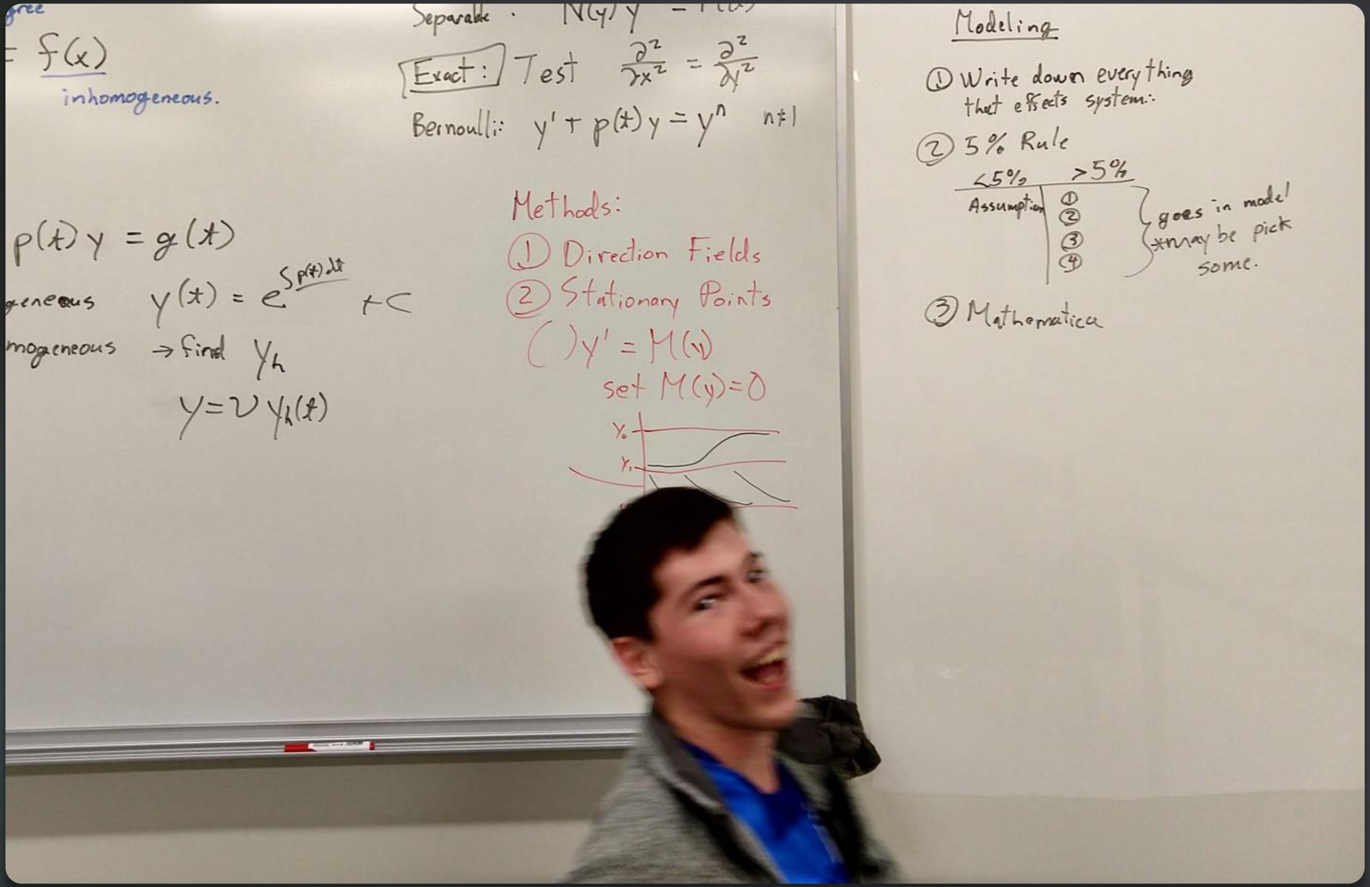


The Missing Link

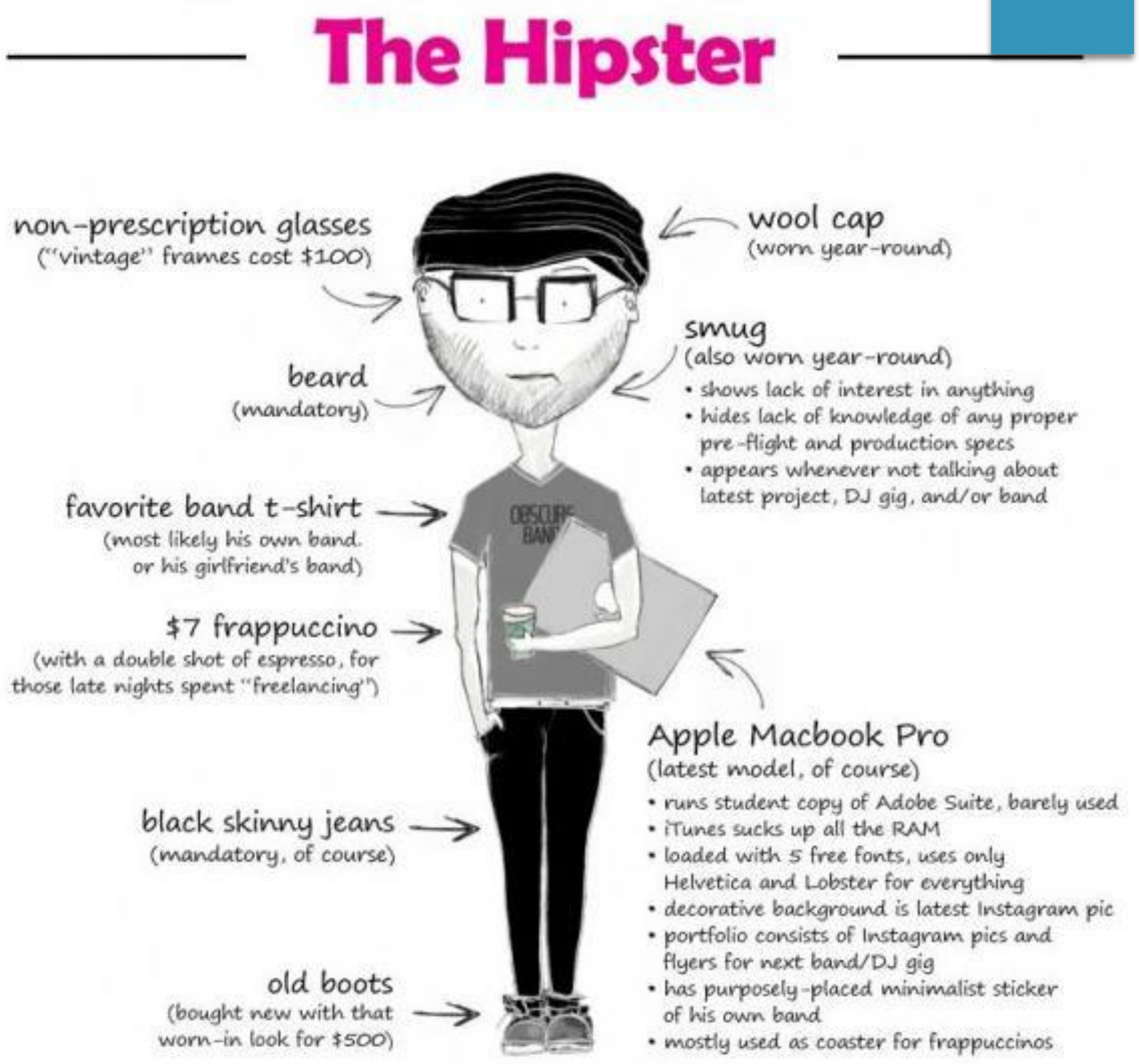
Problem A: Group Affinity & Fashion Sense

How do people identify with groups (hipsters specifically)?

- Model how people within groups interact and change their appearance.
- Describe how long it takes for people to change appearance.
- Analyze which parts of the model impact how subgroups change and how quickly the change occurs.

Define Hipster

- If I did, it would be too mainstream to maintain accuracy.

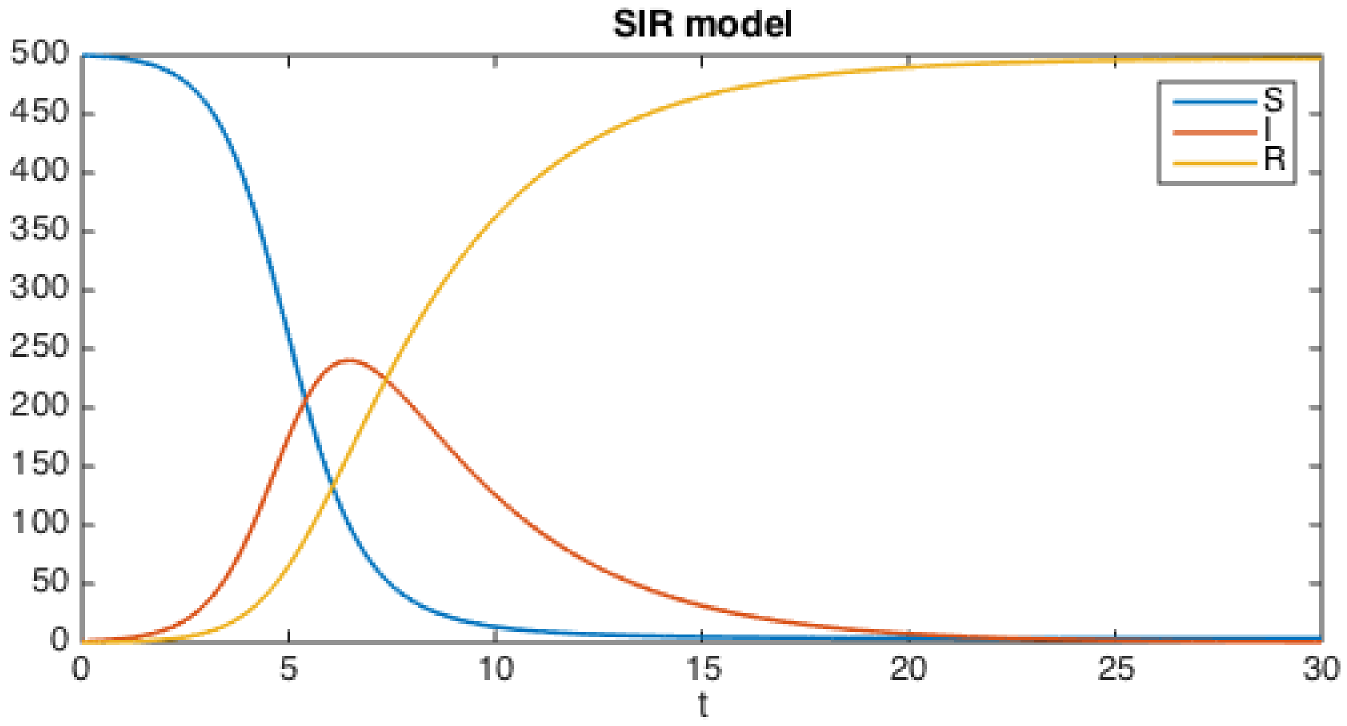


The "SIR" Model

- $S'(t) = -\mathbf{a}\, S(t)\, I(t)$
  - S: number of people susceptible to disease
- $I'(t) = \mathbf{a}\, S(t)\, I(t) - \mathbf{b}\, I(t)$
  - I: number of infected people
- $R'(t) = \mathbf{b}\, I(t)$
  - R: number of people recovered from disease

Why SIR?

- Standard epidemic model
- Models interactions between people
- Diseases analogous to social trends



Why Add to SIR?

- SIR does not account for immunity
- Why not MSIR?
  - M is temporary immunity
  - Immunity not assured until exposure
- Fixed population in SIR; does not allow for large time frames

Custom Modifications

- Add term for immunity
  - $\pm$ **c** S(t)
  - Allow for people to move directly from S group to H group
- Changing population?
  - + 817.13 to S(t)
  - Adds approx. 817 people every day to susceptible pool
  - Ensures model can reach beyond short-term

Our Final Equations

$$S'(t) = -a\,S(t)\,H(t) - c\,S(t) + 817.13$$

$$H'(t) = a\,S(t)\,H(t) - b\,H(t)$$

$$R'(t) = b\,H(t) + c\,S(t)$$

Assumptions

- System population: 21% of US population OR people aged 19-34
- Anyone outside age range not susceptible
- $H(0) = 25\%$ of system pop.
- $S(0) = \text{total} - H(0)$
- Higher H population means slower growth
- Hipster is binary state; either true or false
- 817 people added to $S(t)$ daily
- Hipster population follows chart of Google N-gram history of hipster
- Current day at peak; decline in future
- Hipster population never passes 50% of initial system population

Determining Constants

Recovery Constant (**b**):

- Rate at which people stop being hipsters
- Likely to leave job in approx. 2 years, 12-year period
- Likely in college 4 years, 3 of which during 19-34 age range

$$\boldsymbol{b} = \frac{\left(\frac{1}{2*365}\right)*12+\left(\frac{1}{3*365}\right)*3}{15*365}*.08$$

- Likelihood of a large-scale life change affecting hipsterism multiplied by likelihood of such an event occurring

Determining Constants

Influence Constant (**a**):

- Expected to be very small in SIR model
- Likelihood of a single interaction causing conversion to hipsterism divided by time constant of hipster transformation (1/2 year)

$$\boldsymbol{a} = \frac{1}{.5 * 365} * n$$

- Solve for *n;* found iteratively to be .00000000178

Determining Constants

Immunity Constant (**c**):

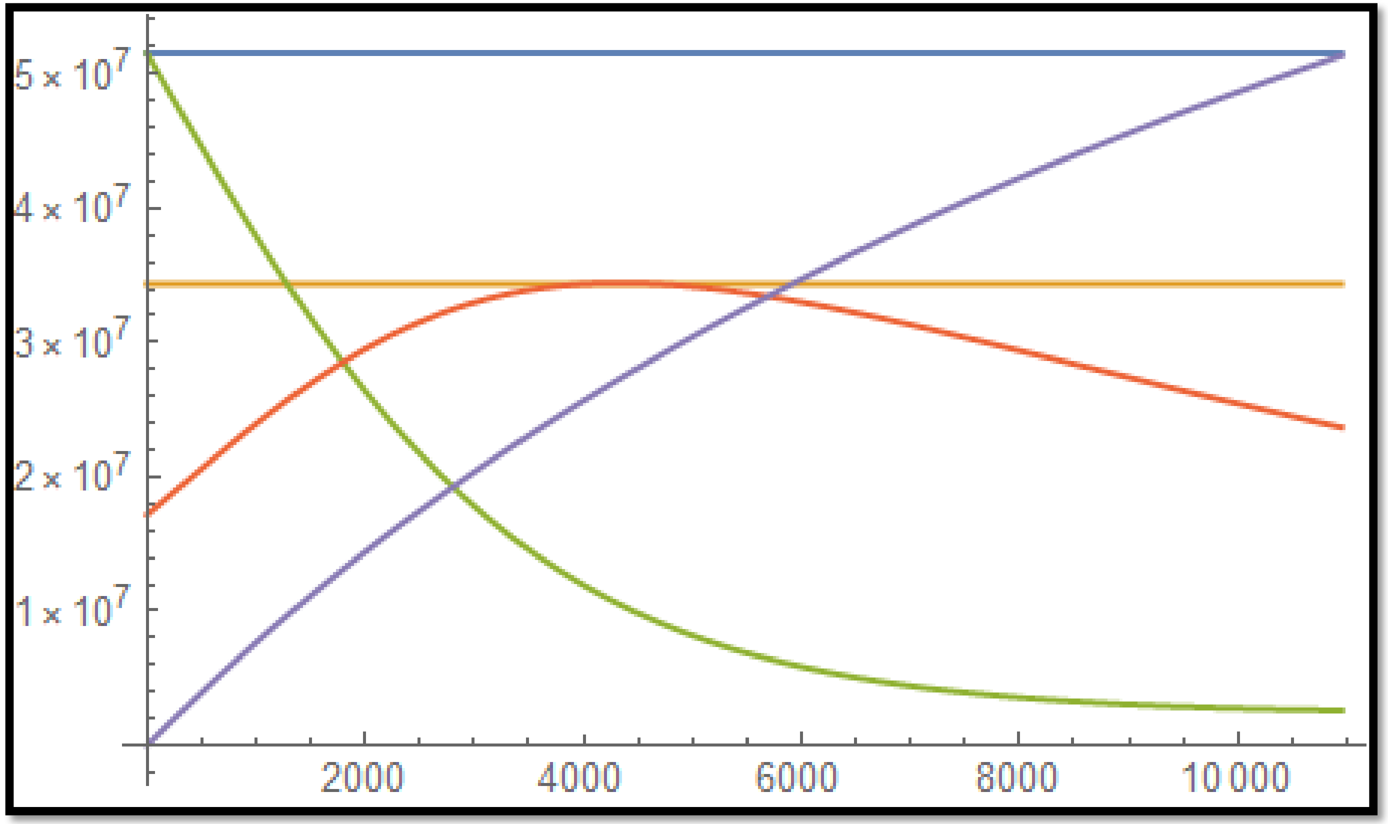
- Rate of people transferring from susceptible group straight to recovered group
- Approximately .01% of susceptible will be immune in a day

$$c = .000125$$

- Note: constants **a**, **b**, **c** designed to fit expected values for H, R

Graphing the System

- S(t)
- H(t)
- R(t)
- .5 Sample pop



Conclusion

- What aspect is being changed?
  - The behavior of our people groups is being changed. Specifically, their fashion sense is going from normal to hipster and (hopefully) back to normal.
- How is information exchanged between groups?
  - Everyday social interactions, social media, mass media, advertising
- Transmission rate n main goal of exercise
  - Describes rate of effectiveness per interaction in turning someone hipster, assuming hipsterization time of 1/2 year
- Values/ranges of parameters
  - What does higher **a**, **b**, **c** do?
- Backward Extrapolation
  - Very little data to find constants empirically

Additional Issue

Issue 2: The original statement asks you to model one aspect that is adopted within a group. How would your model change if you are required to model how two aspects are adopted within a group?

How would the Model Change?

- Add fourth growth constant (**d**) to system

$$S'(t) = -a\,S(t)\,H(t) - c\,S(t) - d\,S(t)\,H(t) + 817.13$$
$$H'(t) = a\,S(t)\,H(t) - b\,H(t) + d\,S(t)\,H(t)$$
$$R'(t) = \qquad b\,H(t) + c\,S(t)$$

- **a** is growth rate for first aspect (appearance); **d** is growth rate for second (lifestyle)

What do we think would happen?

- Previous constants no longer applicable; must be adjusted to conform to new expectations
- Both aspect groups combined into one “infected” group H(t)
  - Aspects not mutually exclusive
- **a** + **d** should approximately equal **a** from original model
- Gives better holistic model of hipsters; multiple aspects of hipster lifestyle, not just one
- Should fit same curves as previous model
- Values could be found through further study of hipster life

Sources Referenced

- Hipster picture: http://www.korsgaardscommentary.com/2012/04/why-hipsters-suck.html
- SIR picture: https://www.chebfun.org/examples/ode-nonlin/ModellingDiseases.html
- 21% of US from 19-34: Kaiser Family Foundation
- Google N-Gram for hipster: Hipsters/year graph