

Who should we send to colonize Mars?

ICM Problem F 2017

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Outline

- Problem F 2017
- Mathematics from Outstanding paper from North Carolina School of Science and Mathematics
- Mathematics from Outstanding paper from Shanghai Jiao Tong University

Problem F 2017

It is 2095 and we are selecting the first 10,000 humans to colonize Mars in 2100, called Population Zero.

The goal is to find the right mix of people to make the living experience on Mars even better than Earth.

The mission of Population Zero is to create a sustainable society by maximizing both **economic output** and **happiness** in the work place for its citizens.

Special Considerations

Income Ensure adequate compensation so that all people can afford fundamental necessities (shelter, food, clothes).

Education Provide high quality education that prepares citizens for the needs and challenges of the 22nd Century.

Equality Improve the retention of women in the workforce, particularly in fields where they have been underrepresented or discriminated against on Earth.

*Healthcare was excluded from consideration in the problem.

Complexity factors

- Individual, subgroup, versus population productivity and happiness
- Understanding the different roles of members of the community over short or long periods of time (10 years or 100 years)
- Projecting life in 2095 to know what “improved” life might look like.
- Modeling factors such as family planning, retirement, disability, unemployment, or other situations that alter some trajectories of productivity and/or happiness

North Carolina School of Science and Mathematics

Population Zero of 10,000 will consist of:

- Mean age of 37

- Workforce

Innovators	Producers
10%	90%

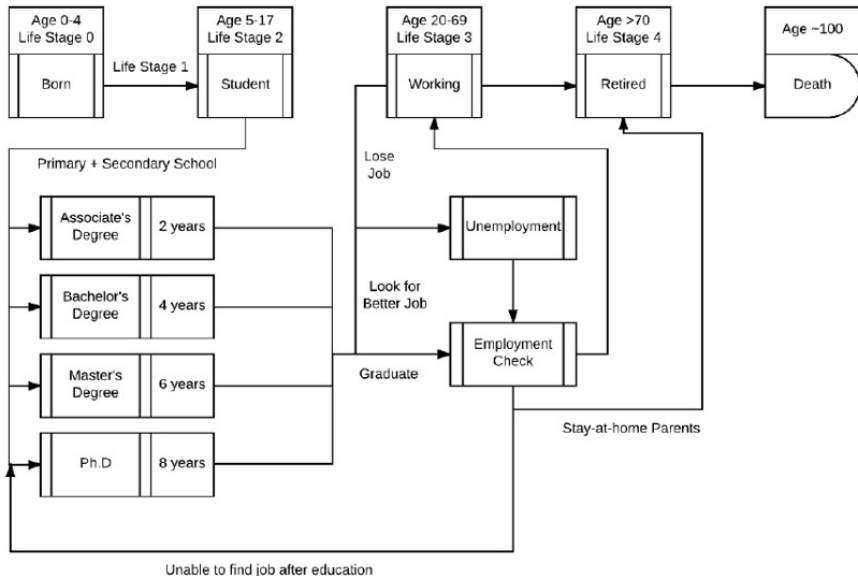
- Parental Leave

Maternity	Paternity
10 months	3 months

- Minimum wage of \$70,000
- Progressive tax system to provide education and infrastructure.
- Happiness survey to constantly monitor population and adjust as needed

Agent based model “as it accurately represents a person’s impact on society as well as the interactions between and within citizens.”

Agents



Parental Leave

The probability a worker will leave the work force to be a stay-at-home parent is inversely proportional to their education level

Level of Education	Male	Female
Associate	0.07	0.25
Bachelor's	0.03	0.19
Master's	0.02	0.09
PhD	0.01	0.06

Minimum wage

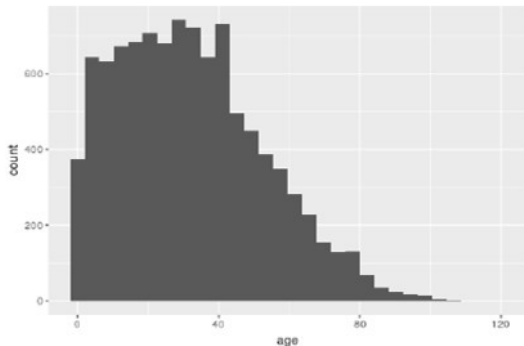
The welfare rate is \$59,000 and retirement is \$45,000.

Minimum Wage	Income Metric	GDP
65,000	181,056	2,431,800,000
70,000	183,379	2,443,000,000
75,000	182,186	2,445,000,000
80,000	182,909	2,448,000,000

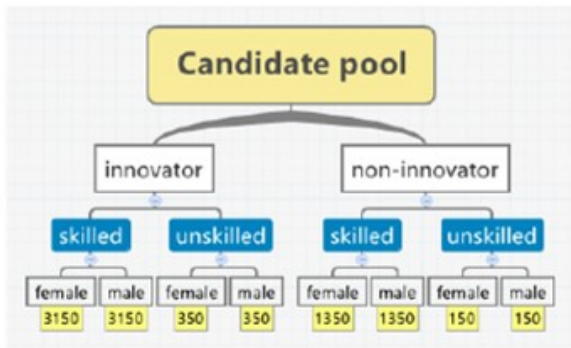
SIMULATION!!!

The inputs into this model are:

- 1 Age
- 2 Occupation
- 3 Gender



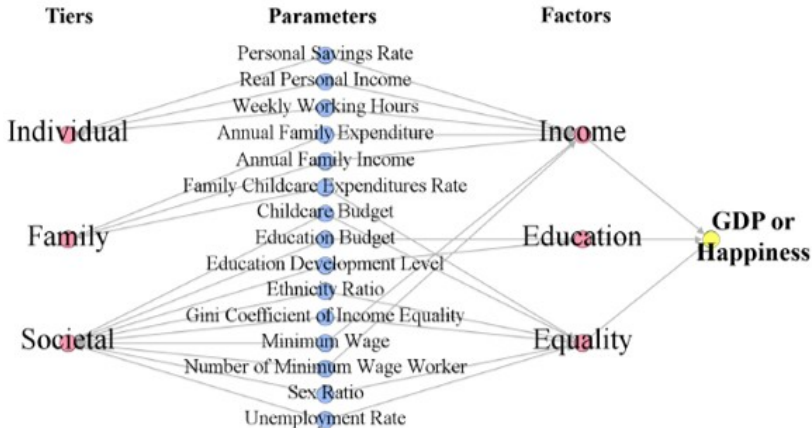
The Population Zero will consist of:



Other demographics

- Highly educated population
- Large portion of under age 40
- Maximize minimum wage to be \$33,526
- Quality education system
- Parental Leave of one year with salary of \$50,200

The Evaluation Model



Evaluating their selection criteria

Tested their suggested population against a random sample from the census data.

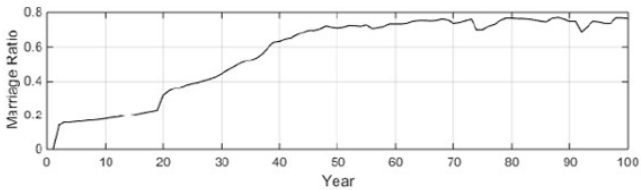
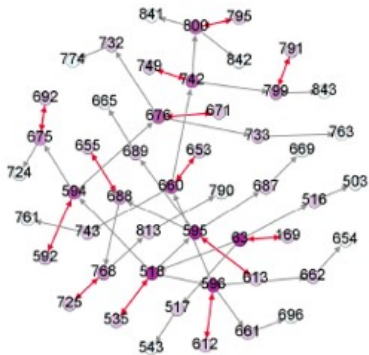
Evolution of the population over time

SIMULATION!

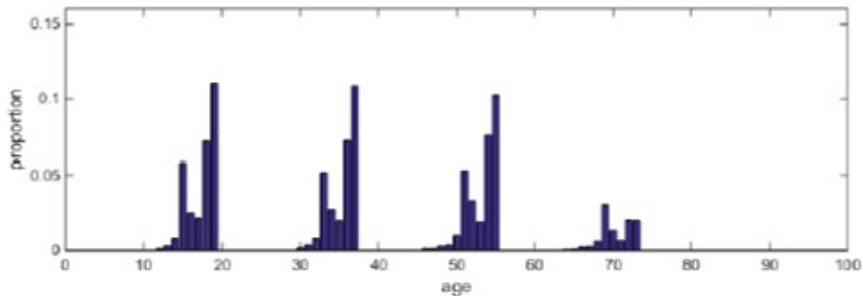
Social Dynamics

- Parental leave policy of 1 year
- Parental leave salary of \$50,200
- If a person is recruited for Population Zero, then so is their spouse.
- Modeled marriage with a probabilistic distance metric between two people.
- Considered family units in their evaluation, as this impacts happiness.

Family Dynamics



Age Dynamics



Common skills

- Simulation to assess different groups of individuals in happiness.
- Create a base group to “test” against. Often a random selection of Earthlings.
- Consideration for different roles of different peoples based on age and experience.

Questions?

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