Sex, Religion, Politics

One-Slide Summary
- The substitution model for evaluating Scheme does not allow us to reason about mutation. In the environment model:
  - A name is a place for storing a value. define, cons and function application create places. set! changes the value in a place.
  - Places live in frames. An environment is a frame and a pointer to a parent frame. The global environment has no parent.
  - To evaluate a name, walk up the frames until you find a definition.
  - A golden age is a period when knowledge or quality increases rapidly.

Outline
- Golden Ages
- Names and Places
- Environment Model

The Real Golden Rule?
Why do fields like astrophysics, medicine, biology and computer science have “endless golden ages”, but fields like …
- rock n’ roll (1962-1973, or whatever was popular when you were 16)
- music (1775-1825)
- philosophy (400BC-350BC?)
- art (1875-1925?)
- soccer (1950-1966)
- baseball (1925-1950?)
- movies (1920-1940?)

have short golden ages?
Think about it over the break!

Golden Ages or Golden Catastrophes?

Malthusian Catastrophe

"The great and unlooked for discoveries that have taken place of late years in natural philosophy, the increasing diffusion of general knowledge from the extension of the art of printing, the ardent and unshackled spirit of inquiry that prevails throughout the lettered and even unlettered world, … have all concurred to lead many able men into the opinion that we were touching on a period big with the most important changes, changes that would in some measure be decisive of the future fate of mankind."
Malthus’ Postulates
“I think I may fairly make two postulata. 
- First, that food is necessary to the 
existence of man. 
- Secondly, that the passion between the 
sexes is necessary and will remain nearly 
in its present state. 
These two laws, ever since we have had any 
knowledge of mankind, appear to have been 
fixed laws of our nature, and, as we have not 
hitherto seen any alteration in them, we 
have no right to conclude that they will ever 
cease to be what they now are...”

Malthus’ Conclusion
“Assuming then my postulata as granted, I 
say, that the power of population is 
indefinitely greater than the power in the 
earth to produce subsistence for man. 
Population, when unchecked, increases 
in a geometrical ratio. Subsistence 
increases only in an arithmetical ratio. A 
slight acquaintance with numbers will show 
the immensity of the first power in 
comparison of the second.”

Malthusian Catastrophe
- Population growth is geometric: $\Theta(k^n)$ ($k > 1$) 
- Food supply growth is linear: $\Theta(n)$

What does this mean as $n \to \infty$?
Food per person = food supply / population 
= $\Theta(n) / \Theta(k^n)$
As $n$ approaches infinity, food per person 
approaches zero!

Liberal Arts Trivia: 
American Studies
- This American social activist and leading 
figure of the woman’s movement crafted the 
Declaration of Sentiments. Its presentation, 
at the first women’s rights convention in 
Seneca Falls, is often credited with initiating 
the first woman’s suffrage movement in the 
USA. Beyond voting rights, her work 
addressed parental and custody rights, 
employment and income rights, property 
rights, divorce laws, and birth control.

Liberal Arts Trivia: 
Classics and Drama
- This ancient Greek tragedian playwright 
wrote Ajax, Antigone, Trachinian Women, Oedipus the King, Electra, Philoctetes and Oedipus at Colonus. He influenced the 
development of the drama by adding a third 
actor (reducing the importance of the chorus 
in the presentation of the plot) and putting a 
greater emphasis on character development.

Malthus’ Fallacy
Malthus’ Fallacy

He forgot how he started:
“The great and unlooked for discoveries that have taken place of late years in natural philosophy, the increasing diffusion of general knowledge from the extension of the art of printing, the ardent and unshackled spirit of inquiry that prevails throughout the lettered and even unlettered world…”

Golden Age of Food Production

• Agriculture is an “endless golden age” field: production from the same land increases as $\Theta(1.02^n)$
• Increasing knowledge of farming, weather forecasting, plant domestication, genetic engineering, pest repellants, distribution channels, etc.

Growing Corn

1906: <1,000 pounds per acre
2006: 10,000 pounds per acre

Michael Pollan’s The Omnivore’s Dilemma

Corn Yield

http://www.agbioforum.org/v2n1/v2n1a10-ruttan.htm

Example: Norman Borlaug

• Father of the Green Revolution
  - Nobel Peace Prize, Presidential Medal of Freedom, Congressional Gold Medal (one of five to win all three), India’s Padma Vibhushan
  - "At a time when doom-sayers were hopping around saying everyone was going to starve, Norman was working. He moved to Mexico and lived among the people there until he figured out how to improve the output of the farmers. So that saved a million lives. Then he packed up his family and moved to India, where in spite of a war with Pakistan, he managed to introduce new wheat strains that quadrupled their food output. So that saved another million. You get it? But he wasn’t done. He did the same thing with a new rice in China. He’s doing the same thing in Africa – as much of Africa as he’s allowed to visit. When he won the Nobel Prize in 1970, they said he had saved a billion people. That’s BILLION! BUH! That’s Carl Sagan BILLION with a "B"! And most of them were a different race from him. Norman is the greatest human being, and you probably never heard of him."
  - Penn Jillette, on the show Penn & Teller

Upcoming Malthusian Catastrophes?

• Human consumption of fossil fuels grows as $\Theta(k^n)$ (fairly large $k$ like 1.08?)
• Available fuel is constant (?)
Malthus was wrong about #2 Also

Advances in science (birth control), medicine (higher life expectancy), education, and societal and political changes (e.g., regulation in China) have reduced $k$ (it is < 1 in many countries now!)

“Cornucopian View”

- Few resources are really finite
- All scientific things seem to have endless golden ages
- (We hope) Human ingenuity and economics and politics will solve problems before they become catastrophes
  - No one will sell the last gallon of gas for $2.35

“Kay”-sian View

The best way to predict the future is to invent it.
— Alan Kay

Charge

- When picking majors, pick a short golden age field that is about to enter its short golden age
  - This requires vision and luck!
- Play it safe by picking an endless golden age field (CS is a good choice for this!)

Liberal Arts Trivia: French Literature

- This 19th century French writer and political activist was an exponent of the Romantic movement in France. Two of his volumes of poetry, Les Contemplations and La Légende des siècles are particularly critically acclaimed, and he is sometimes called the greatest French poet. Outside of France he is perhaps best known for Les Misérables and Notre-Dame de Paris.
- Bonus points: Give Valjean's prisoner number.

Liberal Arts Trivia: French History

- This 1806 Parisian monument commemorates those who fought for France, particularly in the Napoleonic Wars. Underneath it is the Tomb of the Unknown Soldier from WWI.
Liberal Arts Trivia: Mathematics

• This is a major area of mathematics that combines developments and concepts from set theory and geometry, such as those of dimension, space, transformation and shape. Of particular importance to this field are homeomorphisms, which can viewed as continuous functions with continuous inverses. Subfields include point-set, algebraic, and geometric.

Review: Names, Places, Mutation

• A name is a place for storing a value.
• A define creates a new place.
• A cons application creates two new places, the car and the cdr.
• A frame is a collection of places.
• An environment is a frame and a pointer to a parent environment.
  - The global environment has no parent.
• (set! name expr) changes the value in the place name to the value of expr.

Environments

- The global environment points to the outermost frame. It starts with all Scheme primitives.

> (define x 3)

> (define (double (lambda (x) (+x x)))

How To Draw Procedures

• A procedure needs both code and an environment
  - Think of make-incrementer … where are x and y?
    • (define (make-incrementer x)
    • (lambda (y) (+x y))
  - We draw pictures like this:

> (define double (lambda (x) (+ x x)))

Procedures

> (define double (lambda (x) (+ x x)))

> (define (double (lambda (x) (+x x))))

> (define x 3)

> (define (double (lambda (x) (+x x))))
Application

• Old rule: (Substitution model)

Apply Rule 2: Constructed Procedures.
To apply a constructed procedure, evaluate the body of the procedure with each formal parameter replaced by the corresponding actual argument expression value.

New Application Rule 2:

1. Construct a new environment, whose parent is the environment to which the environment pointer of the applied procedure points.
2. Create places in that frame for each parameter containing the value of the corresponding operand expression.
3. Evaluate the body in the new environment. Result is the value of the application.

Evaluation Rule 2: Names

A name expression evaluates to the value associated with that name.
To find the value associated with a name, look for the name in the frame associated with the evaluation environment. If it contains a place with that name, the value of the name expression is the value in that place. If it doesn’t, the value of the name expression is the value of the name expression evaluated in the parent environment if the current environment has a parent. Otherwise, the name expression evaluates to an error (the name is not defined).
Homework

- PS 5 due Monday Oct 18
- Read Course Book 9 and 10