# CSE396 Outline Notes (in process) 

Kenneth W. Regan University at Buffalo (SUNY)

January 29, 2015

## Some Larger Questions

1. How do Numbers relate to Strings?

## Some Larger Questions

1. How do Numbers relate to Strings?

- $197+48=245$.


## Some Larger Questions

1. How do Numbers relate to Strings?

- $197+48=245$.
- Needs two "carries" in decimal.


## Some Larger Questions

1. How do Numbers relate to Strings?

- $197+48=245$.
- Needs two "carries" in decimal.
- None in binary notation:

$$
11000101+00110000=11110101=255-10
$$

## Some Larger Questions

1. How do Numbers relate to Strings?

- $197+48=245$.
- Needs two "carries" in decimal.
- None in binary notation:

$$
11000101+00110000=11110101=255-10
$$

- We use algorithms to deal even with basic math.


## Some Larger Questions

1. How do Numbers relate to Strings?

- $197+48=245$.
- Needs two "carries" in decimal.
- None in binary notation:

$$
11000101+00110000=11110101=255-10
$$

- We use algorithms to deal even with basic math.
- This hints that there's a lower-level reality.


## Some Larger Questions

2. How does an object relate to representations of it?

## Some Larger Questions

2. How does an object relate to representations of it?

- "This is Not a Pipe."


## Some Larger Questions

2. How does an object relate to representations of it?

- "This is Not a Pipe."
- echo "But is the char after this clause a pipe?" | head


## Some Larger Questions

2. How does an object relate to representations of it?

- "This is Not a Pipe."
- echo "But is the char after this clause a pipe?" | head
- "Syntax Versus Semantics"


## Some Larger Questions-3

3. Sets and Logic

## Some Larger Questions-3

3. Sets and Logic
4. What happens when we repeat an operation?

## Some Larger Questions-3

3. Sets and Logic
4. What happens when we repeat an operation?
5. Why does grammar matter when speak we?

## Some Larger Questions-3

3. Sets and Logic
4. What happens when we repeat an operation?
5. Why does grammar matter when speak we?
6. Can we forecast when a program or process is going to halt?

## Thu. 1/29: Formal Objects and Their Types

## Thu. 1/29: Formal Objects and Their Types

- Strings and Numbers-covered last time.


## Thu. 1/29: Formal Objects and Their Types

- Strings and Numbers-covered last time.
- Sets-were covered last time as "sets of anything." Now we become more specific when building up compound objects.


## Thu. 1/29: Formal Objects and Their Types

- Strings and Numbers-covered last time.
- Sets-were covered last time as "sets of anything." Now we become more specific when building up compound objects.
- Compound builders in programming languages: array, list, struct/record, set, map...


## Thu. 1/29: Formal Objects and Their Types

- Strings and Numbers-covered last time.
- Sets - were covered last time as "sets of anything." Now we become more specific when building up compound objects.
- Compound builders in programming languages: array, list, struct/record, set, map...
- Sequences can be infinite, but lists are usually finite, and tuples are always finite.


## Thu. 1/29: Formal Objects and Their Types

- Strings and Numbers-covered last time.
- Sets - were covered last time as "sets of anything." Now we become more specific when building up compound objects.
- Compound builders in programming languages: array, list, struct/record, set, map...
- Sequences can be infinite, but lists are usually finite, and tuples are always finite.
- Many programming languages treat arrays and lists as similar-so will we.


## Thu. 1/29: Formal Objects and Their Types

- Strings and Numbers - covered last time.
- Sets - were covered last time as "sets of anything." Now we become more specific when building up compound objects.
- Compound builders in programming languages: array, list, struct/record, set, map...
- Sequences can be infinite, but lists are usually finite, and tuples are always finite.
- Many programming languages treat arrays and lists as similar - so will we.
- Lists are of the same type, but tuples can have components of different types.


## Thu. 1/29: Formal Objects and Their Types

- Strings and Numbers - covered last time.
- Sets-were covered last time as "sets of anything." Now we become more specific when building up compound objects.
- Compound builders in programming languages: array, list, struct/record, set, map...
- Sequences can be infinite, but lists are usually finite, and tuples are always finite.
- Many programming languages treat arrays and lists as similar-so will we.
- Lists are of the same type, but tuples can have components of different types.
- So tuples really model structs/records...


## Thu. 1/29: Formal Objects and Their Types

- Strings and Numbers-covered last time.
- Sets-were covered last time as "sets of anything." Now we become more specific when building up compound objects.
- Compound builders in programming languages: array, list, struct/record, set, map...
- Sequences can be infinite, but lists are usually finite, and tuples are always finite.
- Many programming languages treat arrays and lists as similar-so will we.
- Lists are of the same type, but tuples can have components of different types.
- So tuples really model structs/records...like instance objects of classes.


## Thu. 1/29: Formal Objects and Their Types

- Strings and Numbers-covered last time.
- Sets-were covered last time as "sets of anything." Now we become more specific when building up compound objects.
- Compound builders in programming languages: array, list, struct/record, set, map...
- Sequences can be infinite, but lists are usually finite, and tuples are always finite.
- Many programming languages treat arrays and lists as similar-so will we.
- Lists are of the same type, but tuples can have components of different types.
- So tuples really model structs/records...like instance objects of classes.
- A 2-tuple is a pair; a 3-tuple is a triple, etc.


## Building up the ToC World

## Building up the ToC World

- An alphabet is a set of characters, presumably finite: Alphabet = set<char>


## Building up the ToC World

- An alphabet is a set of characters, presumably finite: Alphabet = set<char>
- A string is a list of characters over an alphabet: string = list<char>


## Building up the ToC World

- An alphabet is a set of characters, presumably finite: Alphabet $=$ set<char>
- A string is a list of characters over an alphabet: string = list<char>
- Strings and numbers are our basic objects, and will sometimes be interchangeable.


## Building up the ToC World

- An alphabet is a set of characters, presumably finite: Alphabet $=$ set<char>
- A string is a list of characters over an alphabet: string = list<char>
- Strings and numbers are our basic objects, and will sometimes be interchangeable.
- A language is a set of strings or numbers-usually infinite! Language $=$ set<string> $\approx$ set<int>


## Building up the ToC World

- An alphabet is a set of characters, presumably finite: Alphabet $=$ set<char>
- A string is a list of characters over an alphabet: string = list<char>
- Strings and numbers are our basic objects, and will sometimes be interchangeable.
- A language is a set of strings or numbers-usually infinite! Language $=$ set<string> $\approx$ set<int>
- Common convention: Lowercase Roman m,n,i,j,k,... for integer numbers, $a, b, c, d, \ldots$ for other numbers or chars, $x, y, z, w, v, u, \ldots$ for strings, uppercase Roman L,A,B,C,D,... for languages.

