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Overview

- Algorithms
- Pseudocode
- What are Modules?
- Next time
  - More refinement – good modularisation
  - Variables
  - Parameters

Definitions - Etymology

Algorism (n)

- Arab mathematician Abu Abdullah Muhammad ibn Musa *al-Khwarizmi* (early 9th century)

- Europe became aware of his work on Algebra
- Arab numerals became associated with his name

- Has since evolved to mean all processes for solving

Definitions - Dictionary

Algorithm (n)

“An algorithm is a sequence of finite instructions, often used for calculation and data processing…”

Wikipedia

"A step-by-step problem-solving procedure, especially an established, recursive

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Pseudocode

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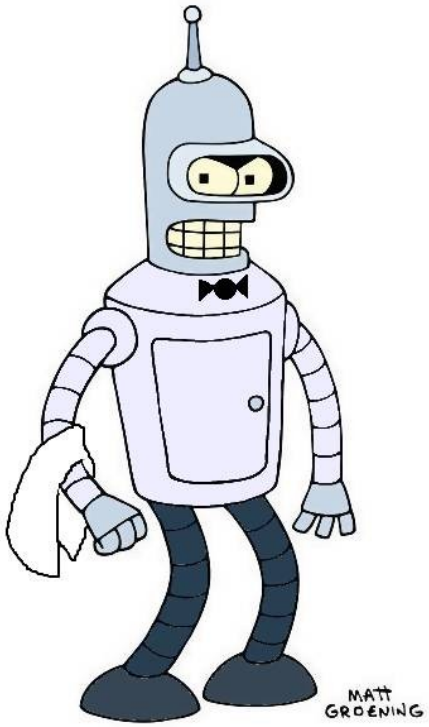
A Problem



A café wants to build an automated system to provide breakfasts. The robot waiter greets people before taking their order by name.

Customers can order different combinations of ingredients for their meal, and also ask for one drink. The system then cooks the breakfast. It must be able to fry sausages, bacon, eggs and mushrooms; toast bread, waffles and muffins; and pour their orange juice or coffee.

The waiter then serves the breakfast.

Where can we start?

Noun Phrase Parsing

- In order to find the key *objects* and *actions*
  - search through the problem definition and
  - extract all the *noun* phrases

- Noun phrases are phrases which describe, individuate or pick-out things in the world
  - for example "customer" individuates an entity which will be represented in the system

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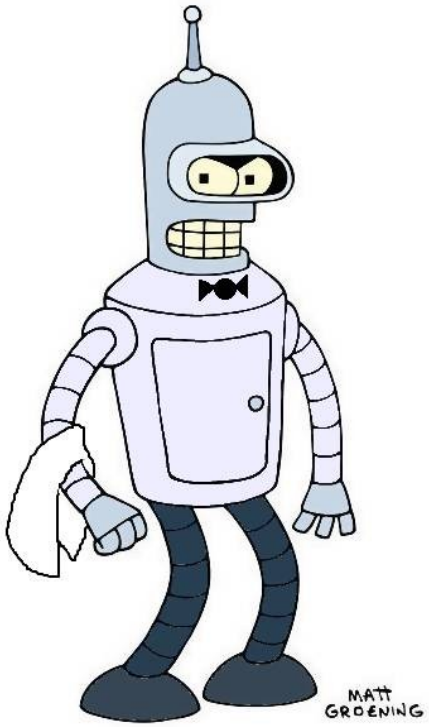

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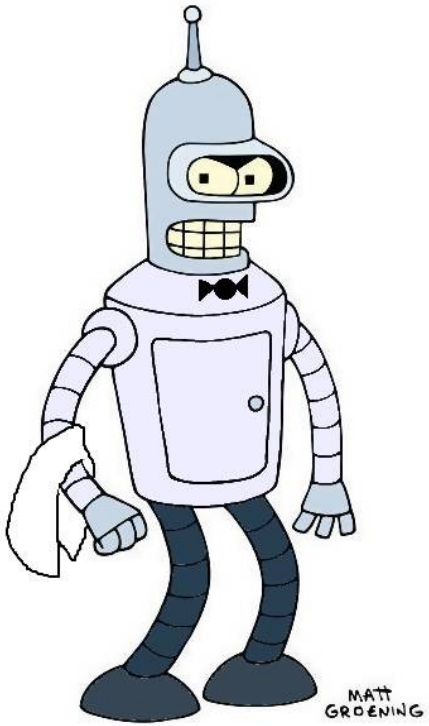

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Verb Phrase Parsing

- In order to find the common processes, look for verb phrases:
  - those which describe "doing things",
  - for example ”cooks" is a process which summarises part of the process

- Don't worry about whether or not the verb phrases describe final processes of the system, or whether or not one subsumes the description of

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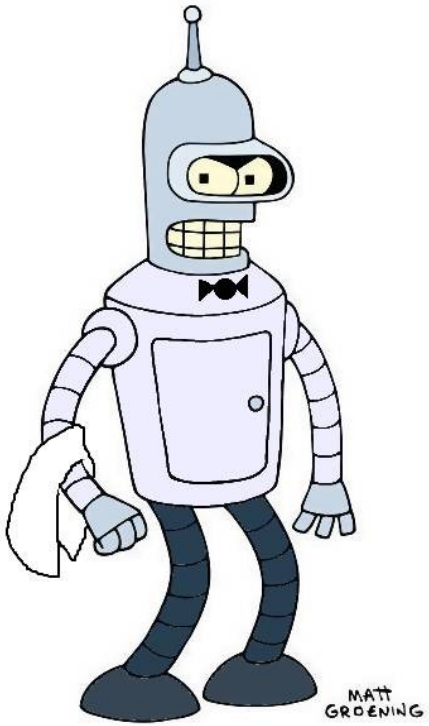

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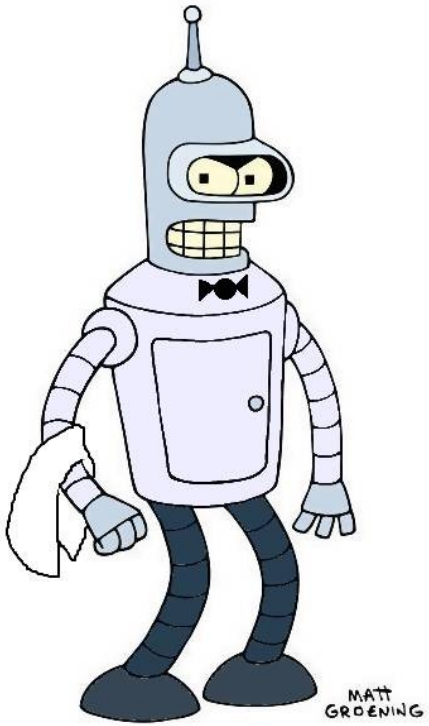

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Tidy up the Lists

- Most often, the requirements will be from a *domain of discourse* or "mini-world" -- a given requirements specification will be in the language of a particular work practice, such as hospitality. Given this, you can:

  - **remove *synonyms*** (noun-phrases which mean the same thing in the domain of discourse).

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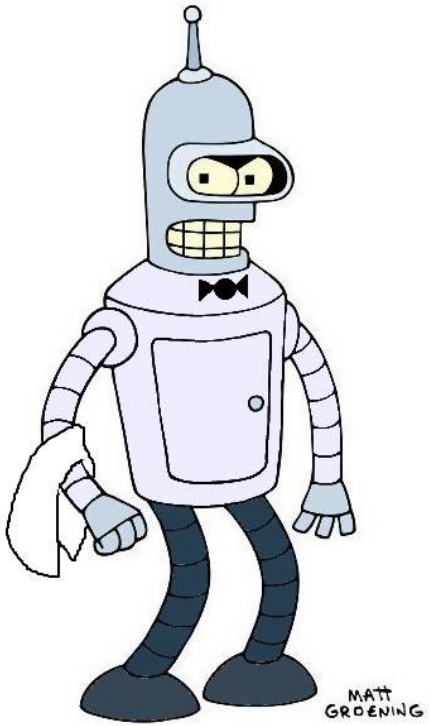

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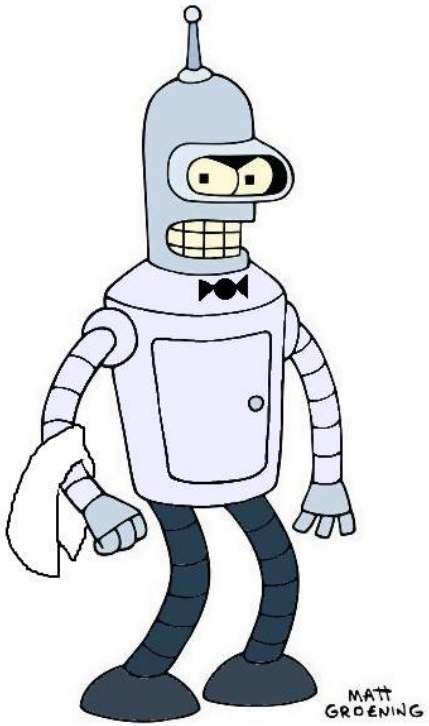

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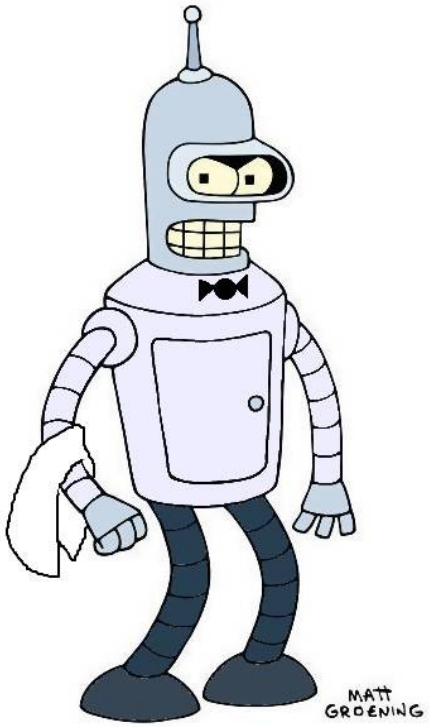
Sketch Processes

- Look for Noun Verb pairs
  - Cook Breakfast
  - Fry Sausage
- The processes may be described at different levels of detail
  - E.g. Fry Sausage is part of Cook Breakfast
- Figure out which noun verb pairs are parts of another
- But Beware!
  - Sometimes there will be a high level phrase (Cook Breakfast)

What are the Noun Verb Phrases?



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Provide Breakfast

Greet People

Take Order

Cook Breakfast

Fry Egg

Fry Sausage

Fry Bacon

Fry Mushroom

Toast Bread

Toast Waffle

Toast Muffin

Pour Juice

Pour Coffee

Serve Breakfast

Noun verb pairs

This a not an algorithm yet -

- We need to refine it step by step.
  - This process of understanding a problem is called *Stepwise Refinement*
- We take the problem and:
  - decompose (break-down)
  - identify modules
  - elaborate (add an appropriate level of detail) and
  - identify holes
- The next step is to revise the design

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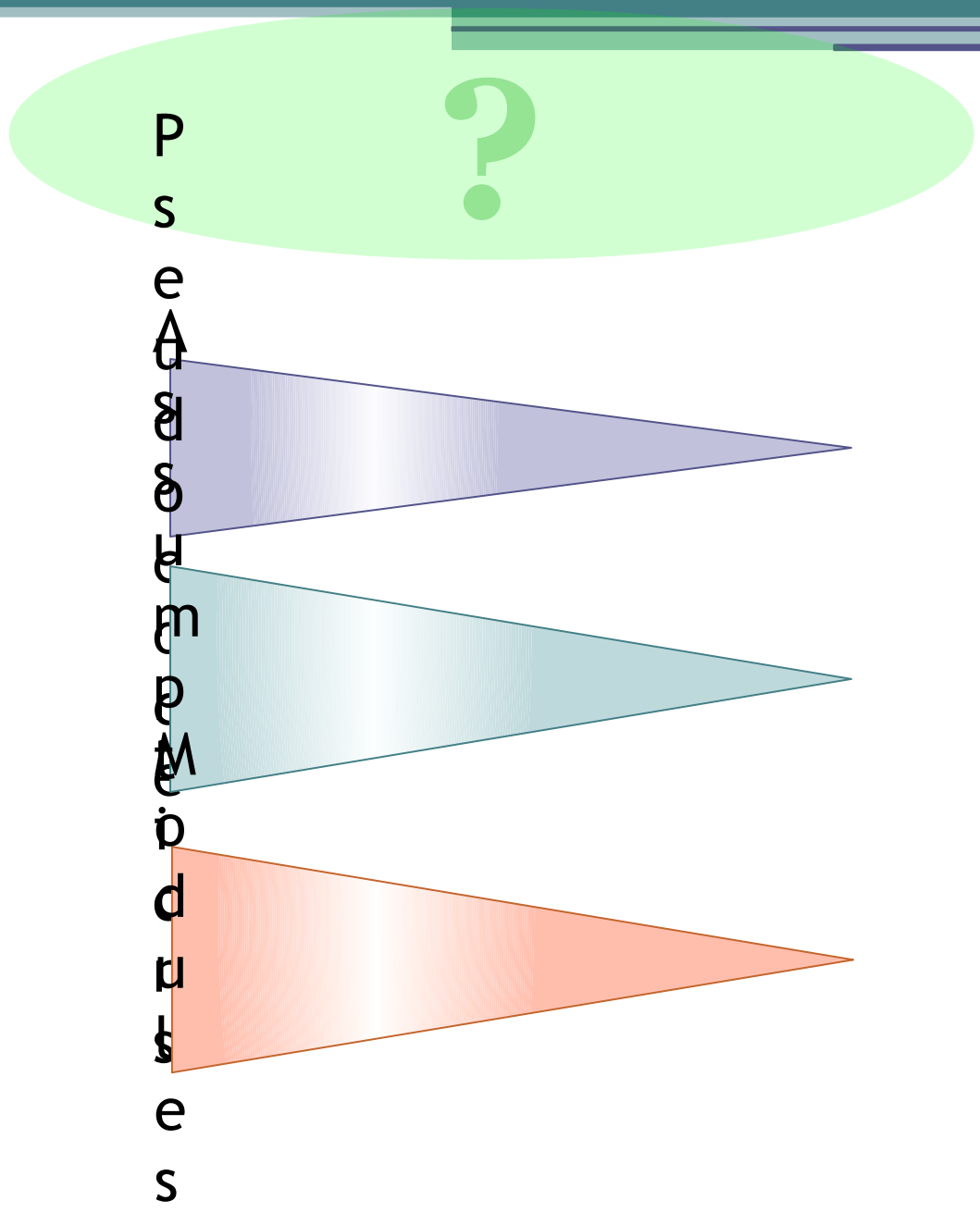

Modules

- Modules break an algorithm into logical parts
  - Helps with Clarity and Understandability
- Modules can be reused
  - Within the same algorithm
  - In a different algorithm
- In Programming Modules can be called:

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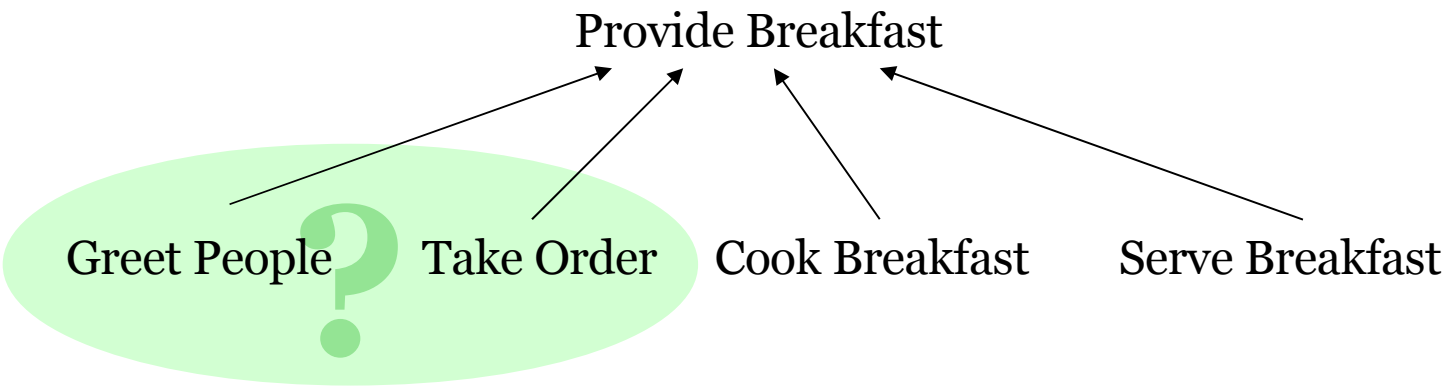

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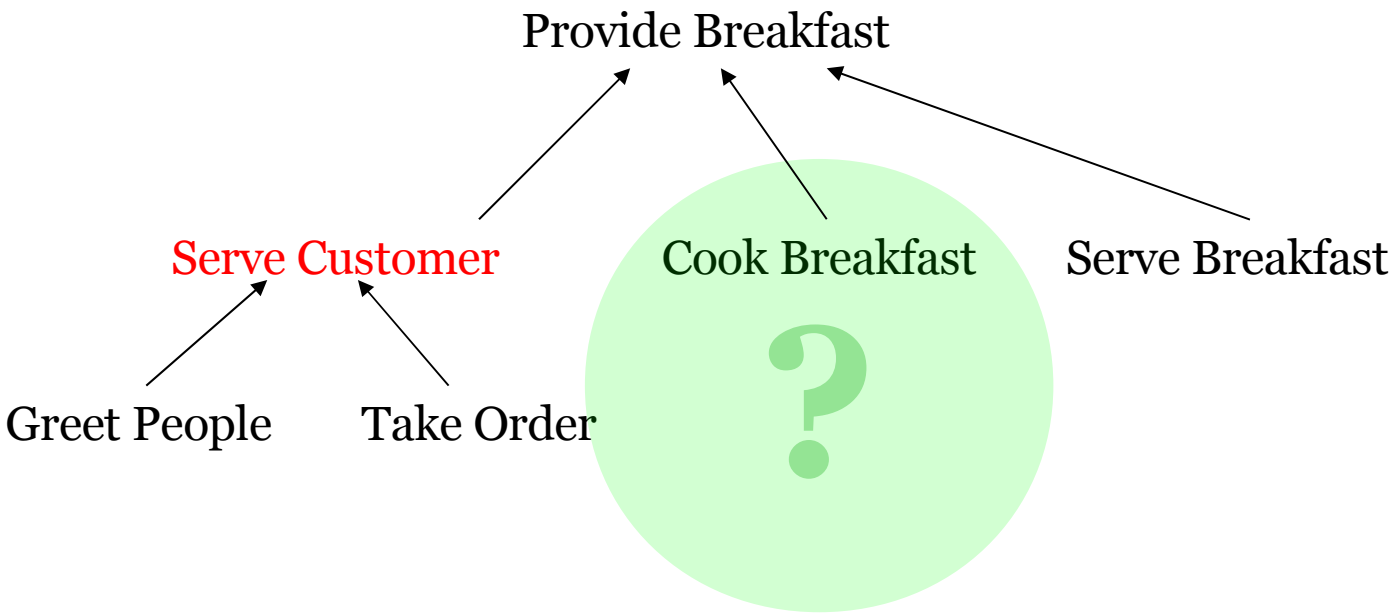

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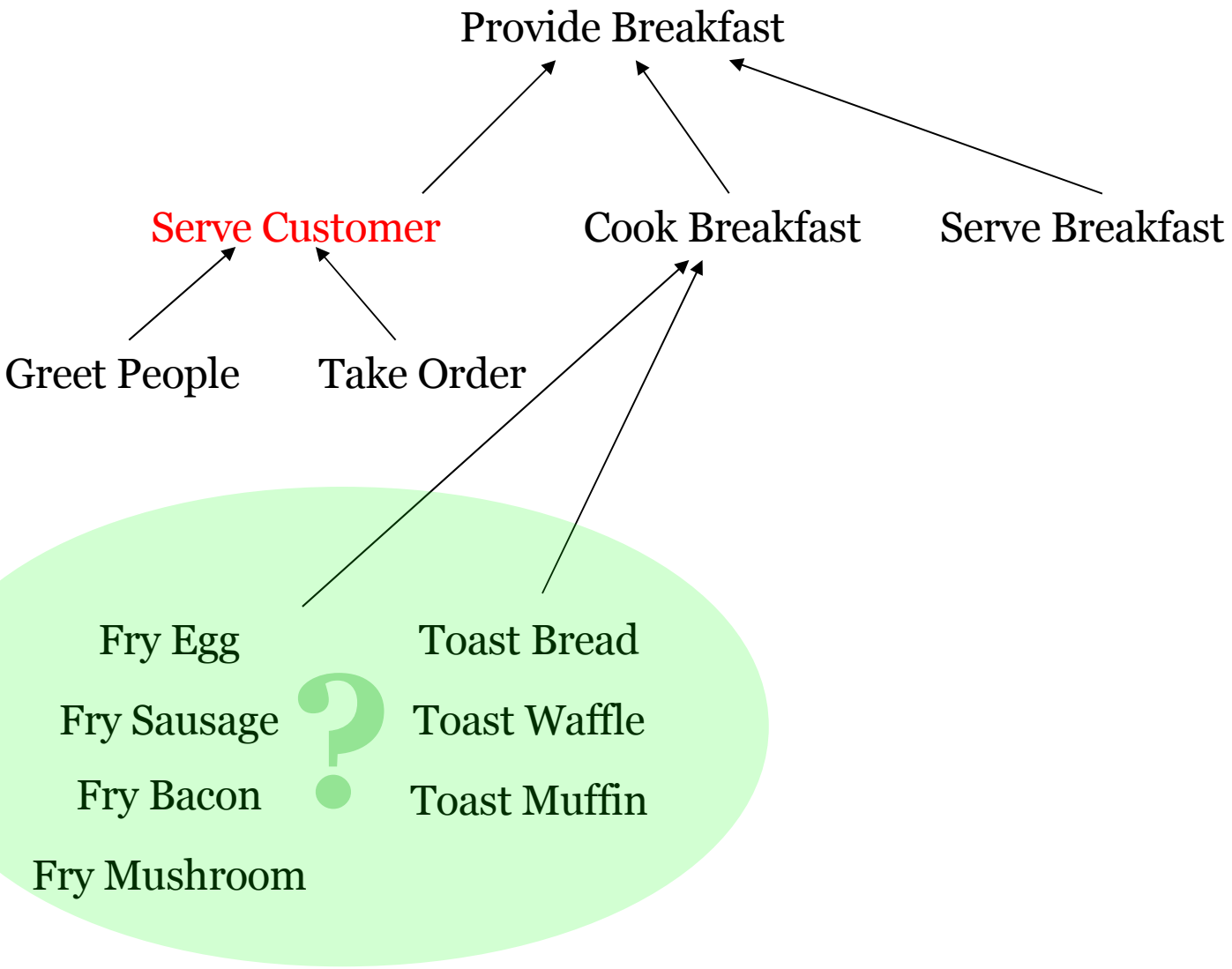

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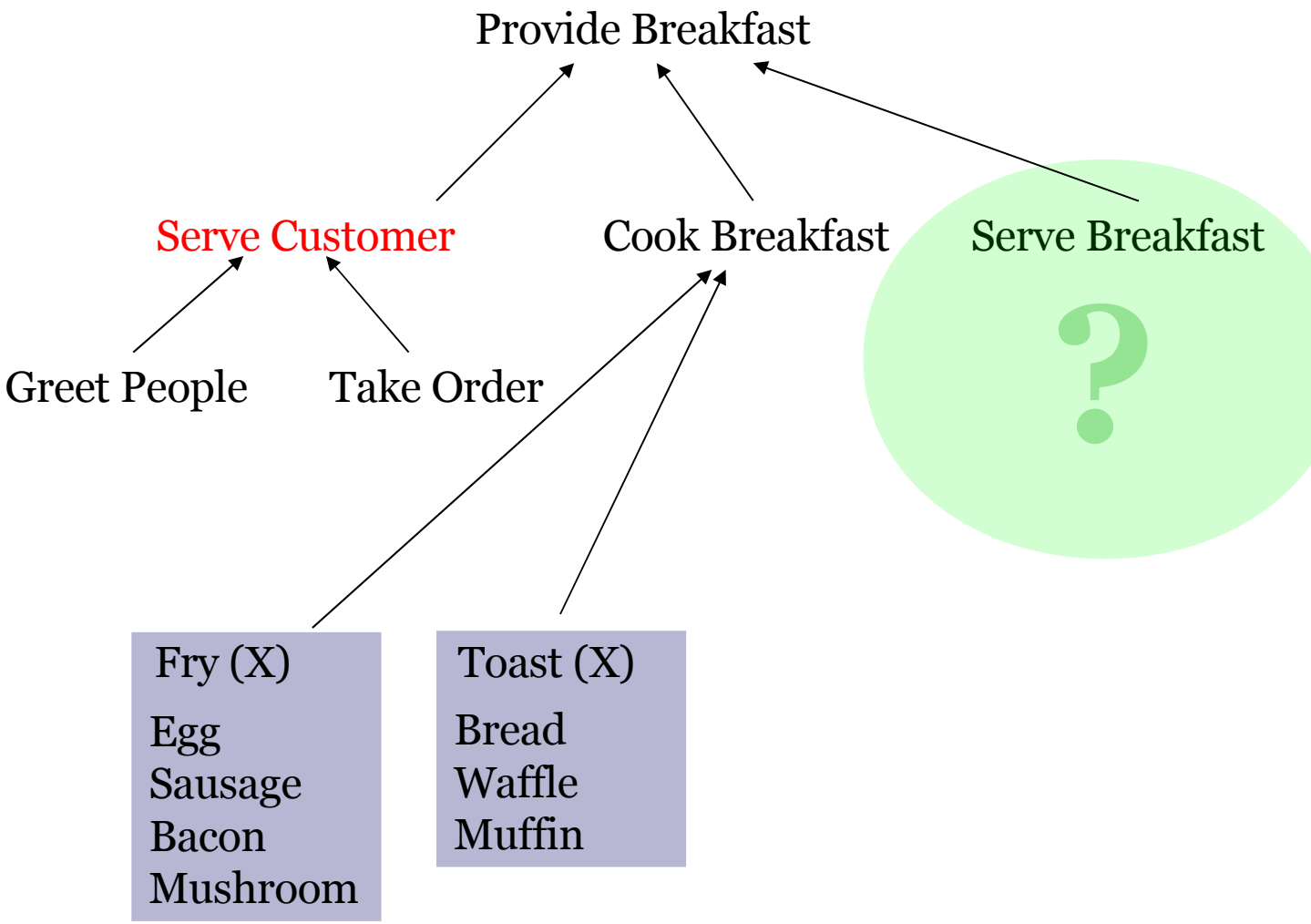

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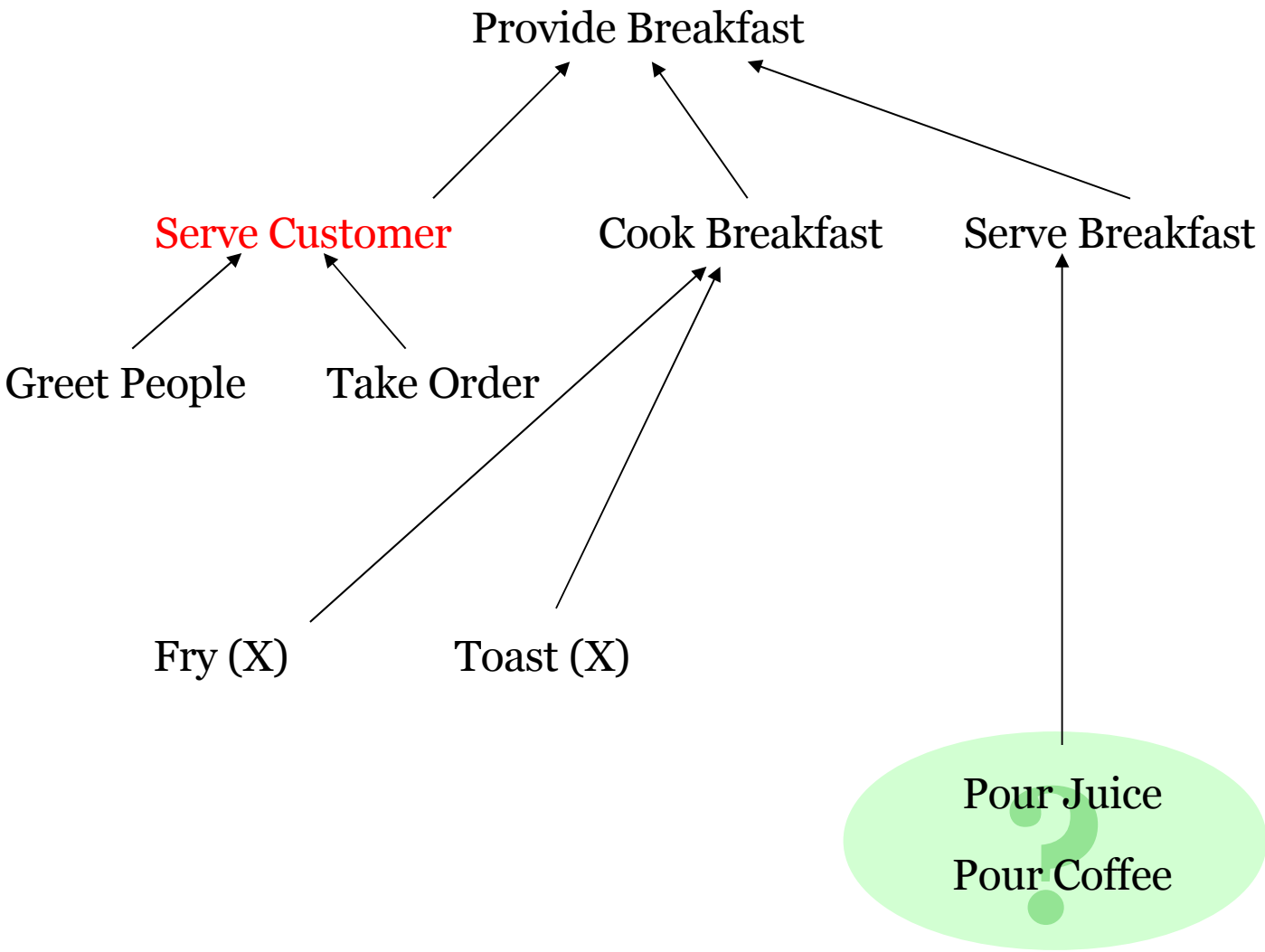

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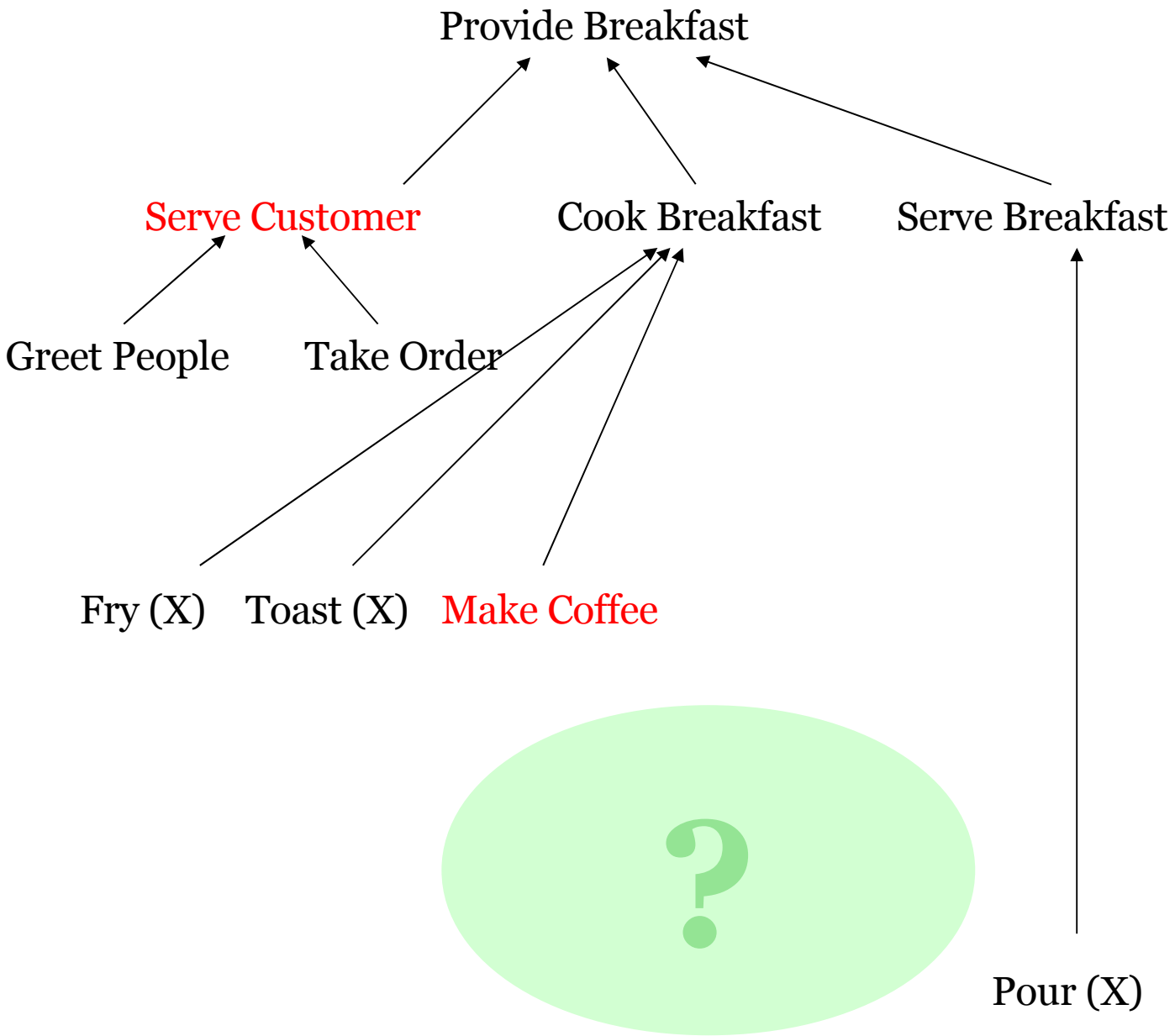
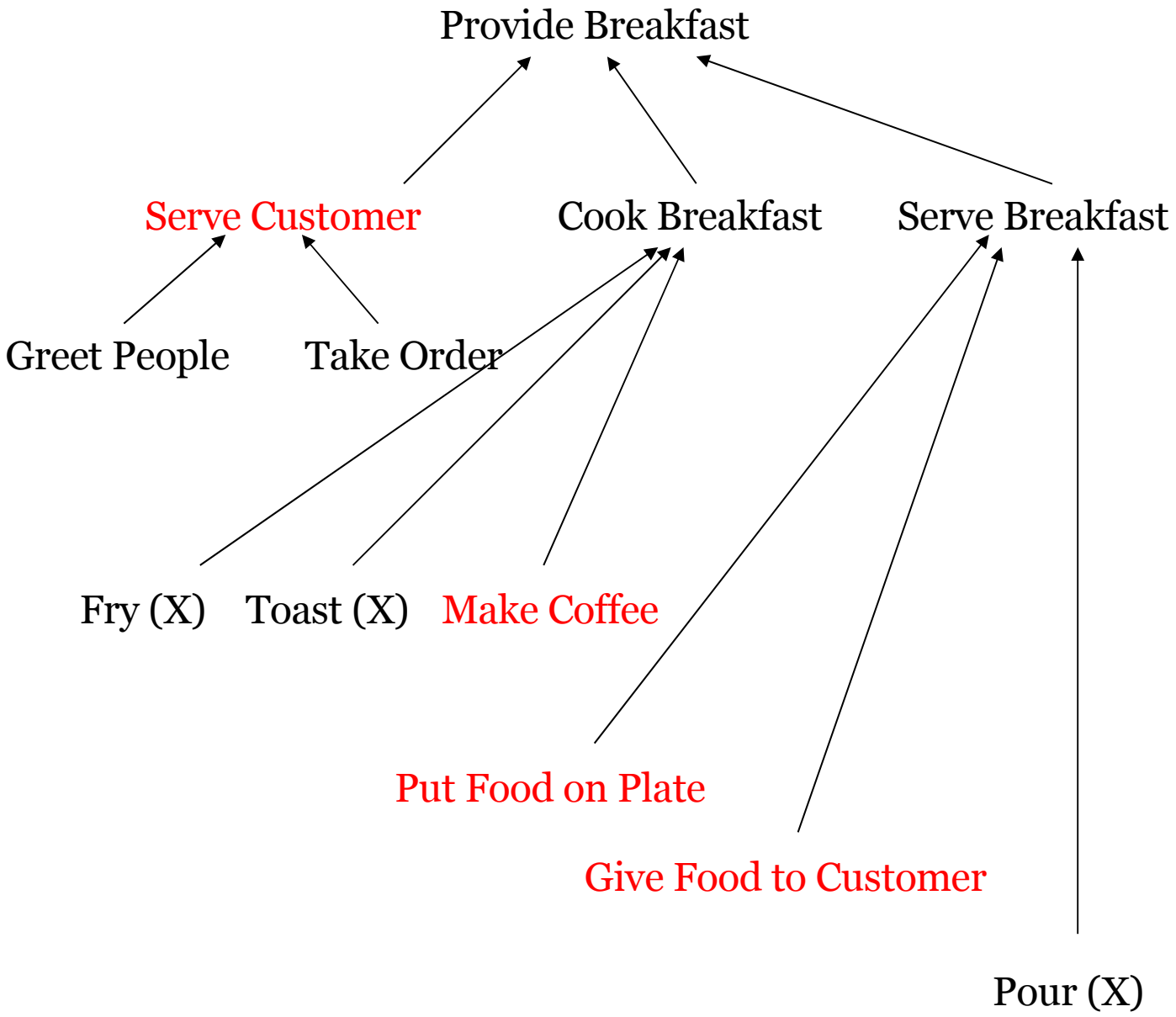



Provide Breakfast
Serve Customer
Cook Breakfast
Serve Breakfast
Greet People
Take Order
Fry (X)
Toast (X)
Make Coffee
Put Food on Plate
Give Food to Customer
Pour (X)

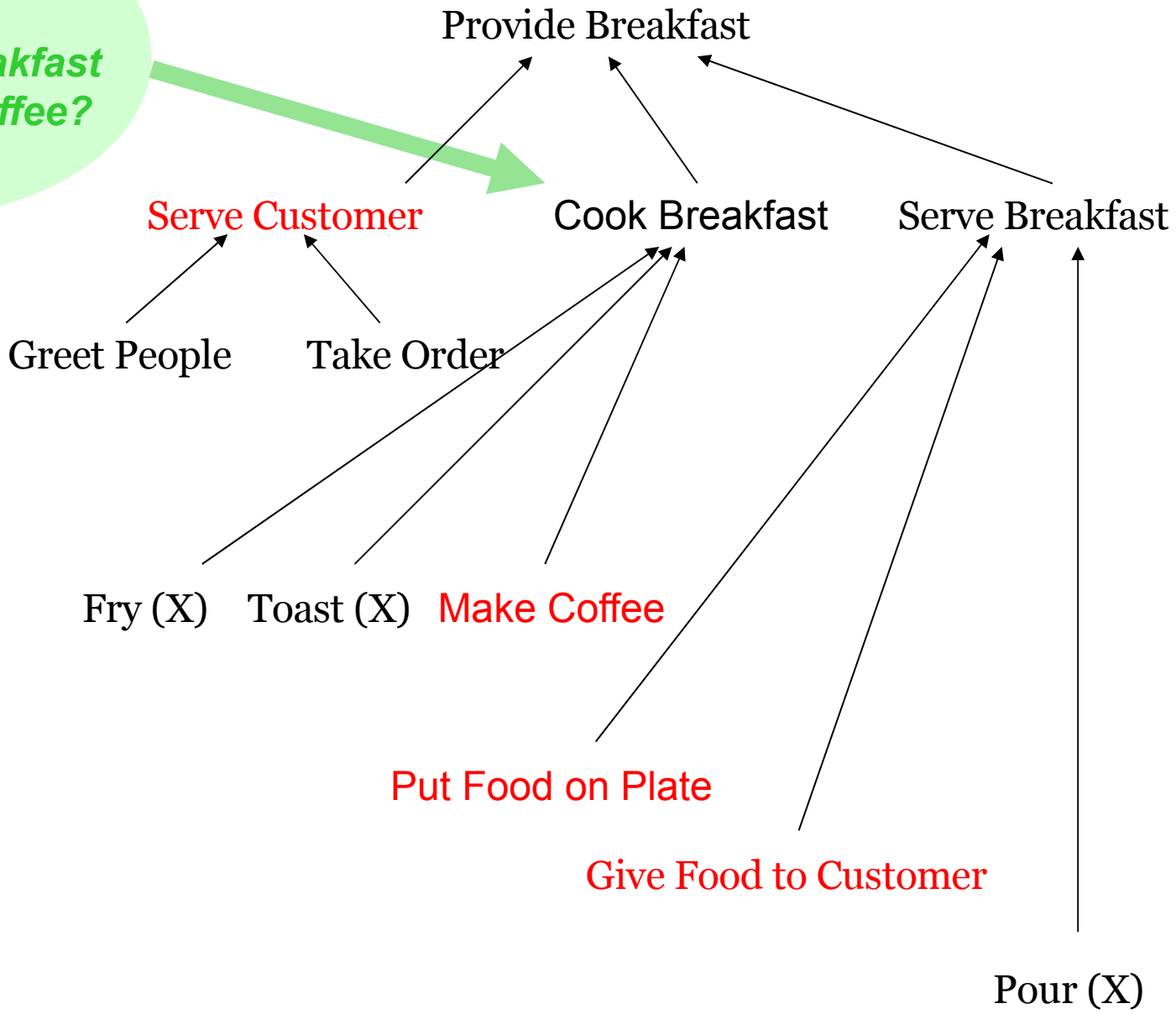
Writing Sequences is Easy…

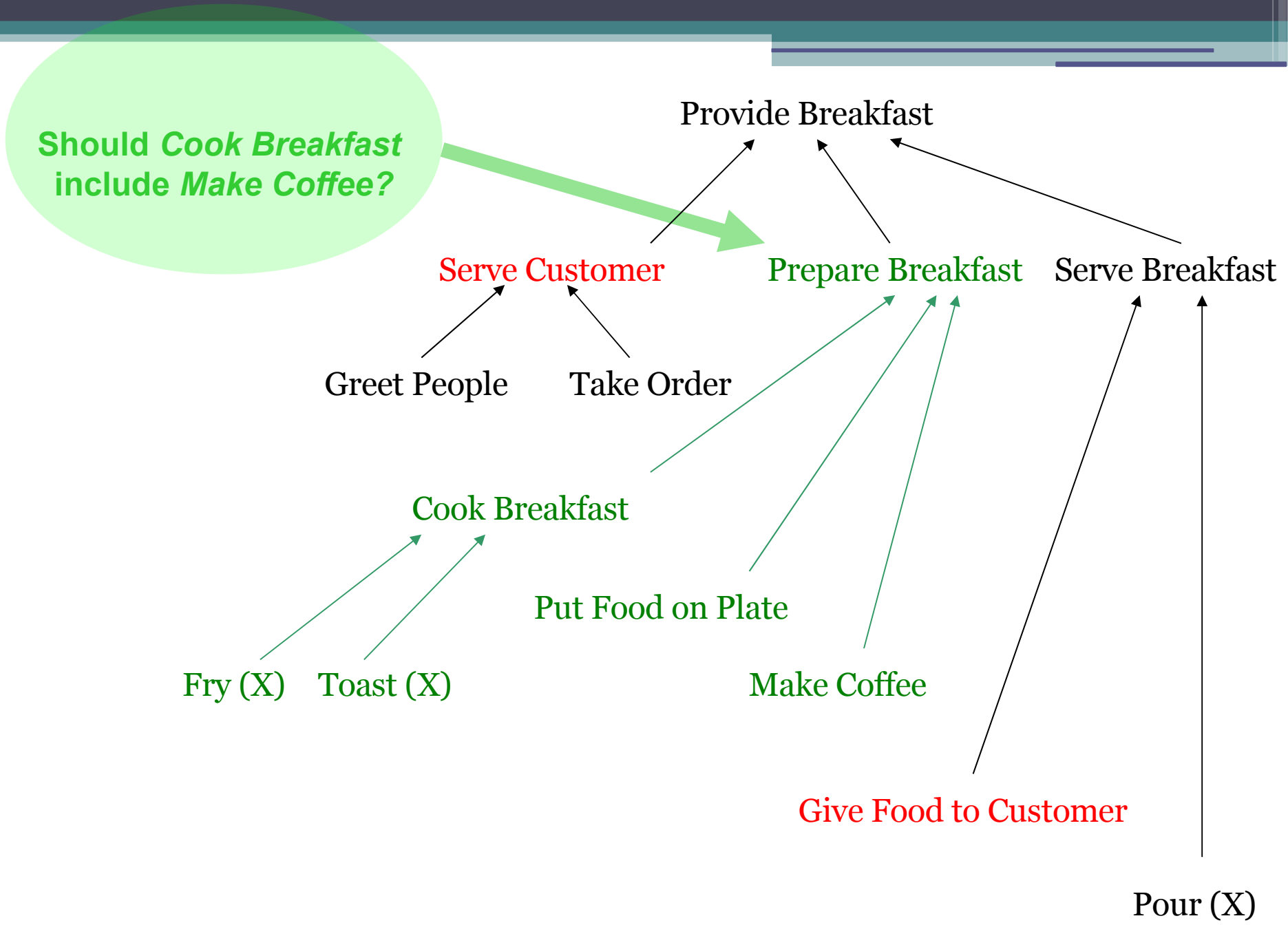
… But getting the sequence right is hard

- Often the specification is inadequate
  - It is easy to make assumptions without realising it
- Making it complete is challenging
  - Making sure not to miss smaller, less-obvious

:

Should *Cook Breakfast* include *Make Coffee?*




Should *Cook Breakfast* include *Make Coffee?*
Provide Breakfast
Serve Customer
Prepare Breakfast
Serve Breakfast
Greet People
Take Order
Cook Breakfast
Put Food on Plate
Fry (X)
Toast (X)
Make Coffee
Give Food to Customer
Pour (X)

Summary

- From Problem to Solution
  - Algorithm
- Pseudocode
  - High level description of algorithm…
  - … intended for human reading…
  - … but structured like a programming language
- Noun Verb Parsing