# Hierarchical Task analysis

Tasks Analysis makes it possible to design and allocate tasks appropriately within the new system. Once the tasks are defined, the functionality required to support the tasks can be accurately specified

# Introduction

- What are Tasks
  - What the user has to do (or thinks what he/she has to do) in order to accomplish a goal
  - Each task should be
    - Meaningful
    - Associated with a goal
    - Identifiable by the user
- What is Task Analysis
  - A process of analyzing the way people perform their tasks
    - The things they do, The things they act on, The things they need to know

To clean the house

- Get the vacuum cleaner out
- Fix the appropriate attachments
- Clean the rooms
- When the dust bag gets full, empty it
- Put the vacuum cleaner and tools away

Must know about:

- vacuum cleaners, their attachments, dust bags, cupboards, rooms, etc.

# Task Decomposition

- What is Task Decomposition
  - A top-down process in which a task is split into subtasks by sequence
- Aims
  - Describe the actions users do
  - Structure actions in a task-subtask hierarchy
  - Describe order of subtasks
- Hierarchical Task Analysis (HTA)
  - Outputs are a **hierarchy** of tasks and subtasks and **plans** describing in what order and under what conditions subtasks are performed
  - Shown as textual descriptions or diagrams
    - Information may be more accessible at a glance with diagrams, especially in hierarchies with many levels

0. Clean the house
    1. Get the vacuum cleaner out
    2. Get the appropriate attachment
    3. Clean the rooms
        3.1. Clean the hall
        3.2. Clean the living rooms
        3.3. Clean the bedrooms
    4. Empty the dust bag
    5. Put vacuum cleaner and attachments away

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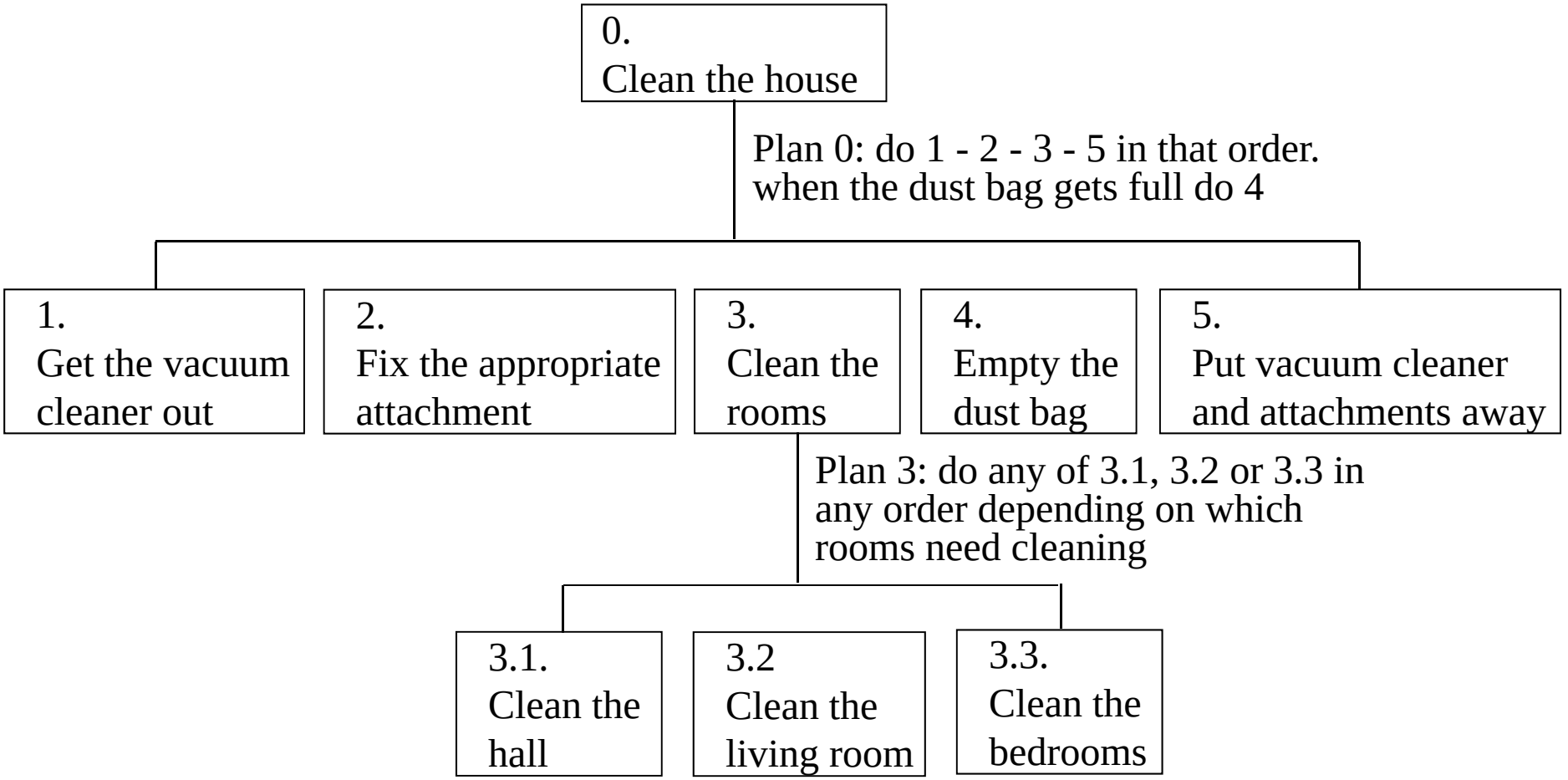
Plans

Plan 0: do 1 - 2 - 3 - 5 in that order. When the dust bag gets full do 4

Plan 3: do any of 3.1, 3.2 or 3.3 in any order depending on which rooms need cleaning

Textual HTA of the Task of Cleaning a House

- Indentation is used to denote the levels in the task hierarchy
- Plans are labeled by the tasks they correspond to
- Only the plans denote the order of task performance
- Not all subtasks need to performed, and not necessarily in the order presented in the hierarchy




Diagrammatic HTA of the Task of Cleaning a House

# Generating Hierarchy

- Identify the Major Task to be Analyzed
  - e.g. clean house, purchase a flight ticket online, etc.
- Break Down the Major Task into Subtasks
  - What subtasks must be accomplished in order to perform the main task
  - Refer to various sources (e.g. direct observation, expert opinion, documentation, etc.)
  - Try to be specific in terms of the objectives of subtasks
- Decide Upon the Level of Detail into Which to Further Decompose the Subtasks
  - Some stopping rule
- Continue the Decomposition Process
  - Keep decompositions and numbering consistent
- Group Some Subtasks (If Too Detailed) into Higher-Level Subtasks
- Present the Hierarchy to a Domain Expert to Check for Errors or Omissions

# Stopping Rule

- Depends on the Purpose of the Task Analysis
  - Put more effort into those subtasks which are directly relevant to the intended purpose

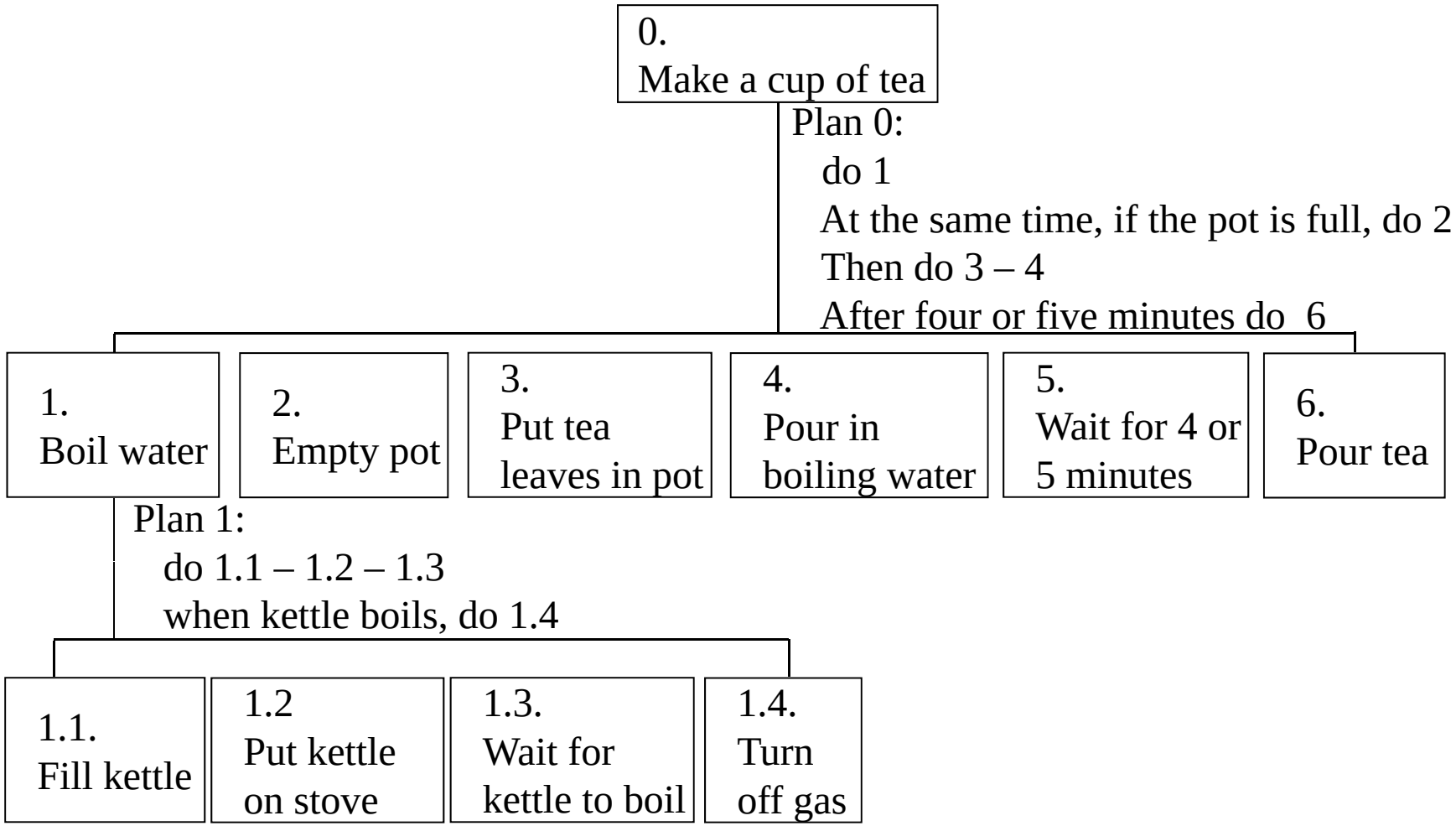
0. In an emergency situation in a chemical plant
   1. Read the alarms
   2. Work out appropriate corrective action
   3. Perform corrective action

• If our ultimate aim is to install computer monitoring of the plant, then we would be interested in expanding subtasks 1 and 3
• If the aim is to produce online operations manuals, then subtask 2 would require expansion

# Stopping Rule

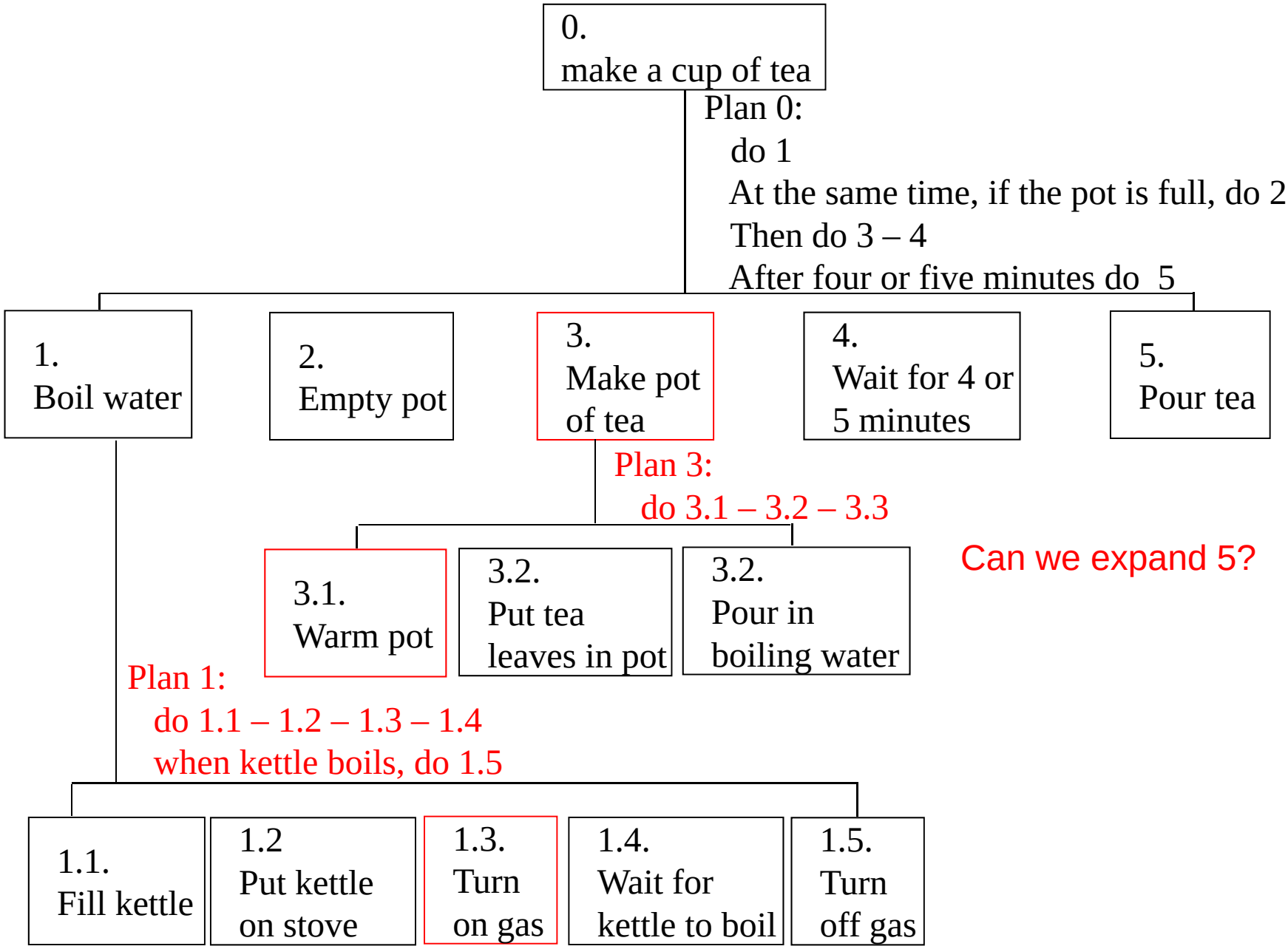
- P × C Rule
  - Particularly appropriate when the aim is to design training materials
  - If the probability of making a mistake in task (P) multiplied by the cost of the mistake (C) is below a threshold, then stop expanding
  - Simple tasks need not to be expanded unless they are critical
- Stop at the point where the task contains purely muscle actions or involves purely cognitive activities
  - e.g. mouse movement, recall someone's name

# HTA of the Task of Making a Cup of Tea




Any omission or error?

Can some first-level subtasks be combined ?


0.
make a cup of tea
Plan 0:
do 1
At the same time, if the pot is full, do 2
Then do 3 – 4
After four or five minutes do 5
1.
Boil water
2.
Empty pot
3.
Make pot of tea
4.
Wait for 4 or 5 minutes
5.
Pour tea
Plan 3:
do 3.1 – 3.2 – 3.3
3.1.
Warm pot
3.2.
Put tea leaves in pot
3.2.
Pour in boiling water
Can we expand 5?
Plan 1:
do 1.1 – 1.2 – 1.3 – 1.4
when kettle boils, do 1.5
1.1.
Fill kettle
1.2
Put kettle on stove
1.3.
Turn on gas
1.4.
Wait for kettle to boil
1.5.
Turn off gas

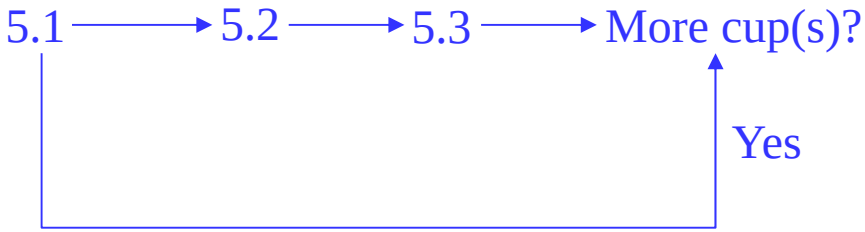
Suppose subtask 5 “Pour tea” can be further decomposed

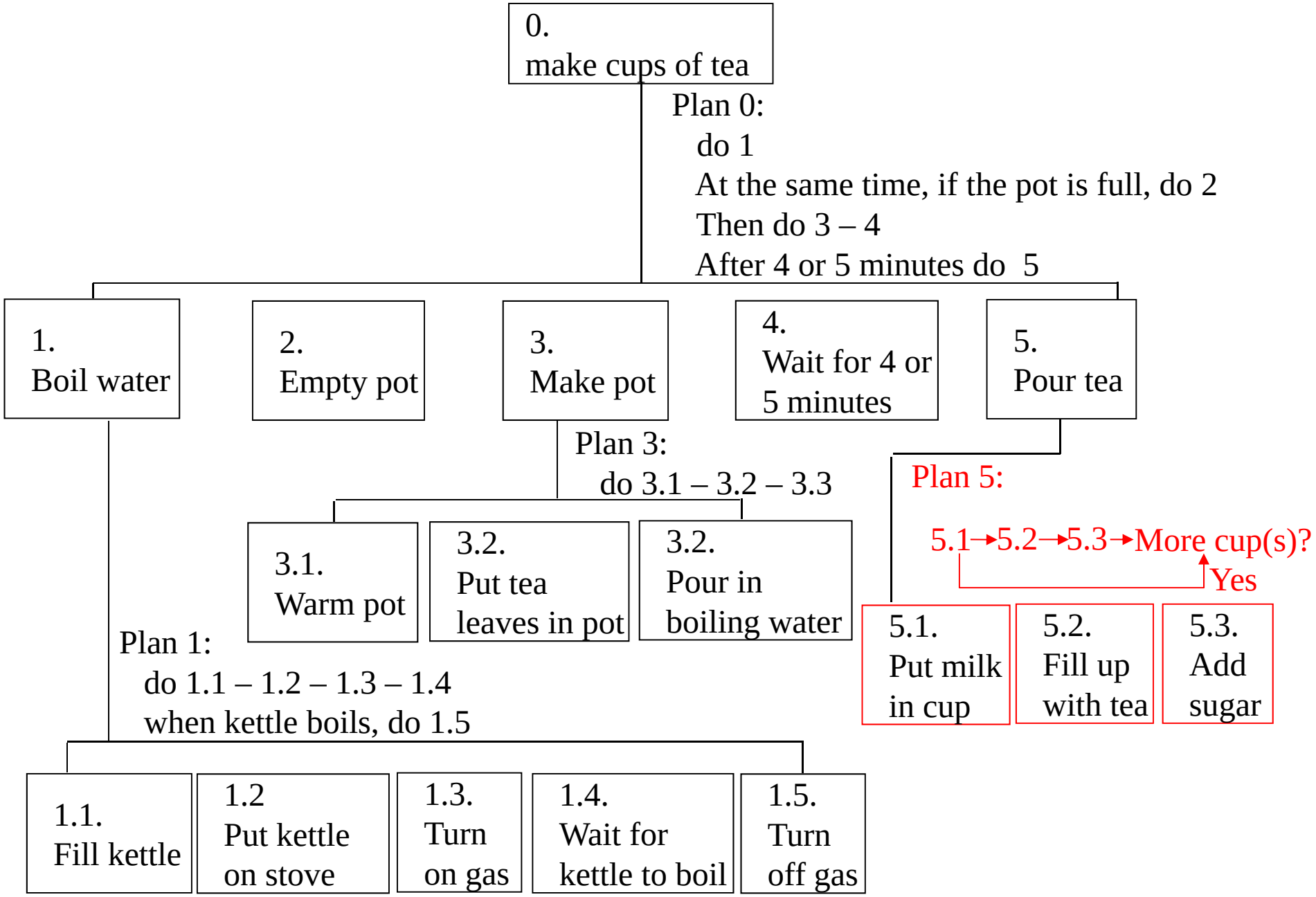
5. Pour tea
    - 5.1. put milk in cup
    - 5.2. fill cup with tea
    - 5.3. add sugar to taste

Plan 5.

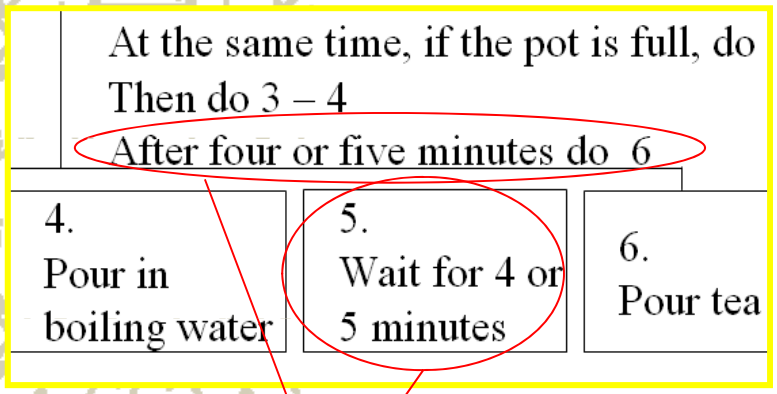
Do 5.1 – 5.2 – 5.3

What if we want to make more than one cup?




0.
make cups of tea
Plan 0:
do 1
At the same time, if the pot is full, do 2
Then do 3 – 4
After 4 or 5 minutes do 5
1.
Boil water
2.
Empty pot
3.
Make pot
4.
Wait for 4 or
5 minutes
5.
Pour tea
Plan 3:
do 3.1 – 3.2 – 3.3
3.1.
Warm pot
3.2.
Put tea
leaves in pot
3.2.
Pour in
boiling water
Plan 5:
5.1→5.2→5.3→More cup(s)?
Yes
5.1.
Put milk
in cup
5.2.
Fill up
with tea
5.3.
Add
sugar
Plan 1:
do 1.1 – 1.2 – 1.3 – 1.4
when kettle boils, do 1.5
1.1.
Fill kettle
1.2
Put kettle
on stove
1.3.
Turn
on gas
1.4.
Wait for
kettle to boil
1.5.
Turn
off gas

# Handling Waiting




- Considered as a subtask if it is a "busy" waiting
  - e.g. The person may be chatting while the tea brews
- Included in the plan if time seems critical for the task sequence
- Perhaps a little redundant in this example, but task analysis is not an exact science

# Types of Plan

- Fixed Sequence
  - The same sequence of subtasks is always followed
    - e.g. Plan 3 in the HTA of tea making
- Optional Subtasks
  - Subtasks that may or may not be performed depending on circumstances
    - e.g. Subtask 2 in plan 0 in the HTA of tea making
- Waiting-For Events
  - Wait for a certain time
    - e.g. Wait for 4 or 5 minutes in plan 0 in the HTA of tea making
  - Wait for the occurrence of some event
    - e.g. Wait for kettle to boil in plan 1 in the HTA of tea making

# Types of Plan

- Cycles
  - Repeat some subtasks until a condition is reached
    - e.g. Repeatedly perform subtasks 5.1 – 5.3 until no more cup is left in the HTA of tea making
- Time Sharing
  - Some subtasks can be done at the same time
    - e.g. Subtasks 1 and 2 can be done at the same time in the HTA of tea making
- Discretionary Subtasks
  - Whether to perform some subtasks is at the people's discretion
    - e.g. In plan 3 in the HTA of room cleaning, the person is allowed to clean any room that he/she thinks needs cleaning and in any order
- Mixtures
  - Most plans are a mixture of different types
    - e.g. Plan 1 in the HTA of tea making is largely a fixed sequence but split by a wait