CS3213 Project – Week 5

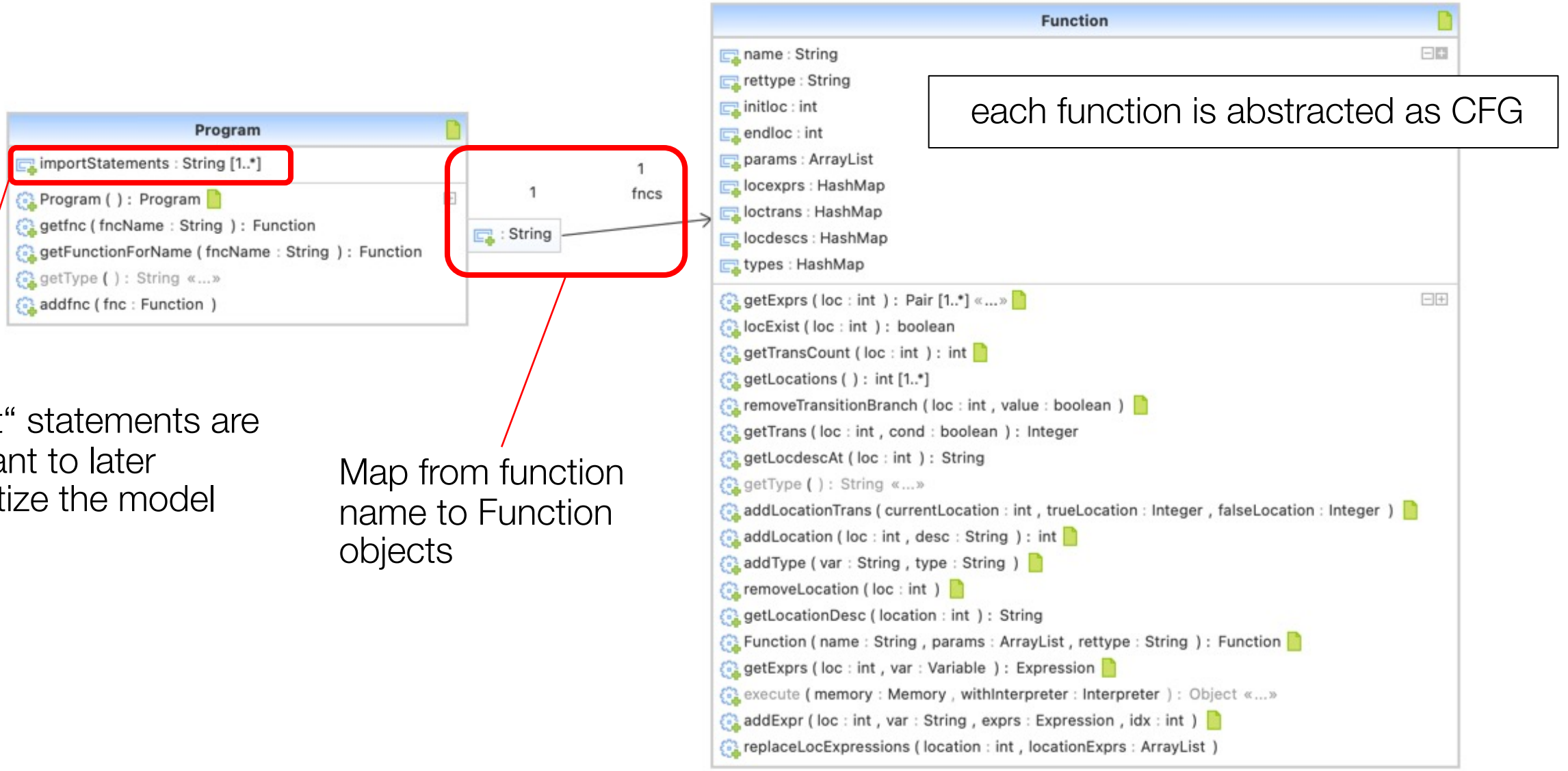
Module Design & Project Planning | 09-02-2022

- ❑ Plagiarism & Attribution
- ❑ its-core: Program model
- ❑ Short Intro to Project Planning
- ❑ Assignment 5

Plagiarism: How to attribute work?

1. Use *code comments* to highlight code which is not your contribution.
2. *Summarize* all attributions in one file in the parent folder of your repository: **`ATTRIBUTIONS.md`**
   - ❏ You need to specify **where** in the code we can find the comment for this attribution (see item 1)
   - ❏ You need to specify the **reference**: where does the code come from?
   - ❏ You need to specify **why** you need to include this code

its-core: Program model (1/3)

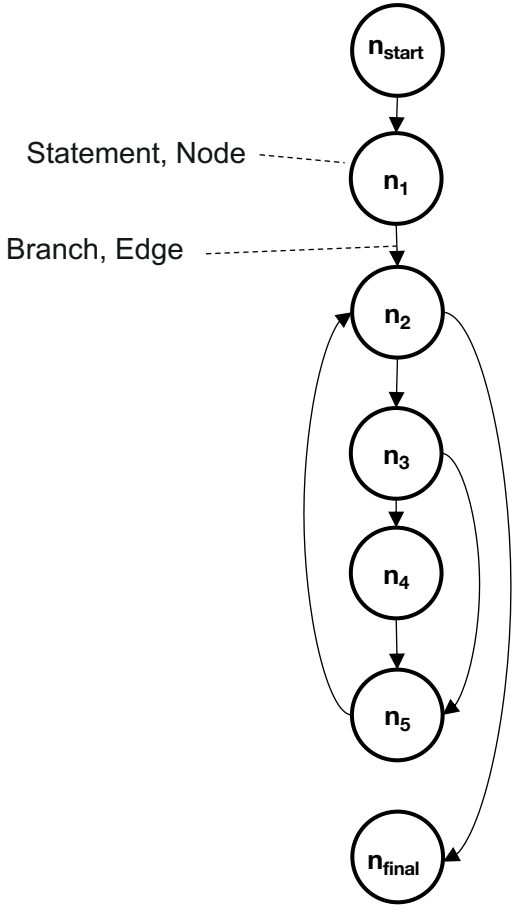


each function is abstracted as CFG

„Import“ statements are important to later concretize the model

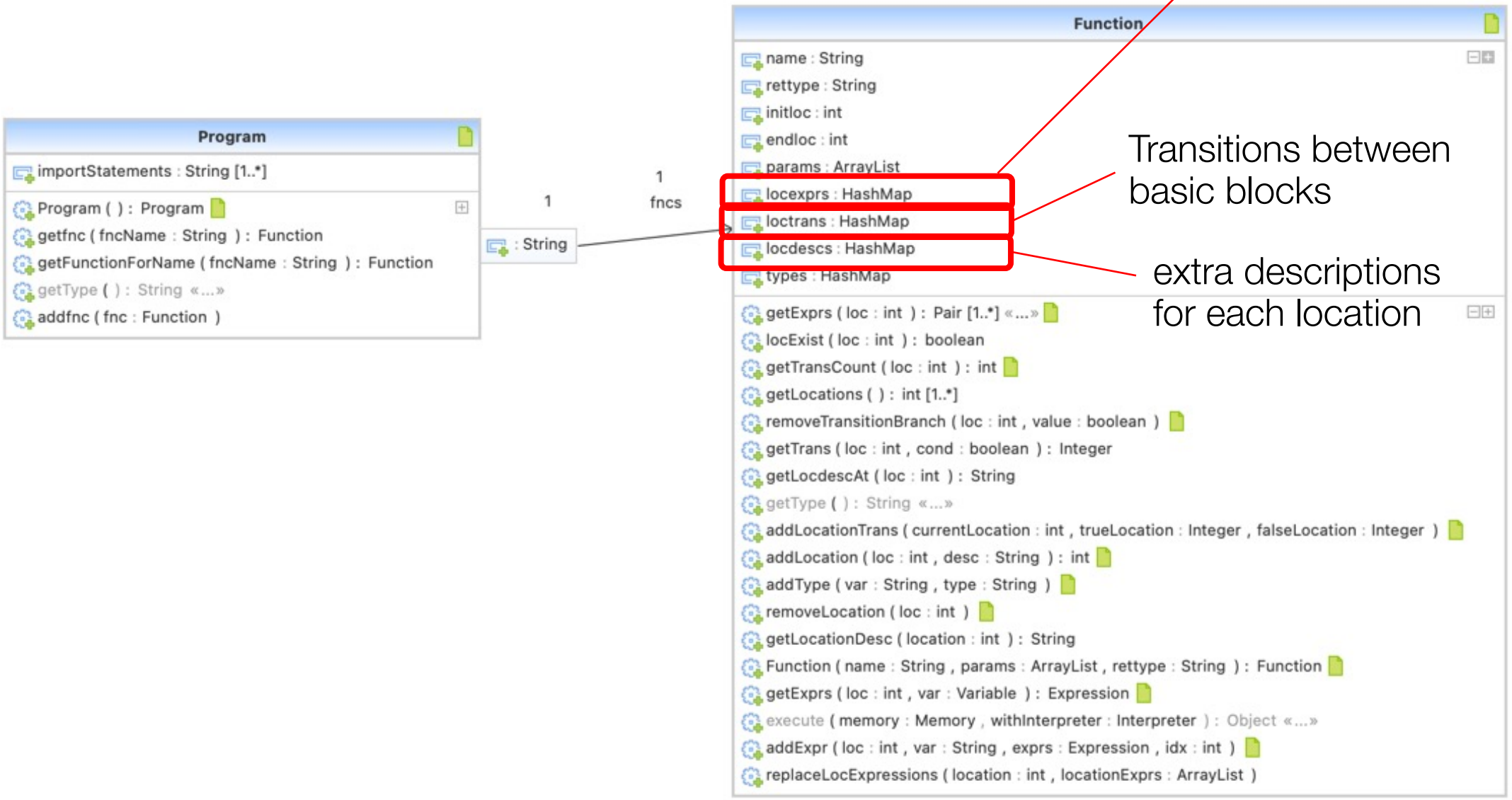
Map from function name to Function objects

Control Flow Graph (CFG) Example




```
void CountChar (int &ACount, int &TotalCount)
{

  char c;
  cin >> c;


  while ((c >= 'A') && (c <= 'Z') && (TotalCount < INT_MAX))
  {


    TotalCount = TotalCount + 1;
    if ((c == 'A'))
    {

      ACount = ACount + 1;

    }

    cin >> c;
  }


}
```

its-core: Program model (2/3)



its-core: Program model (3/3)

its-core: Program model (Example 1/2)

```
#include <stdio.h>
int main() {
  int a=0,b=0;
  b=1+a;
  return 0;
}
```

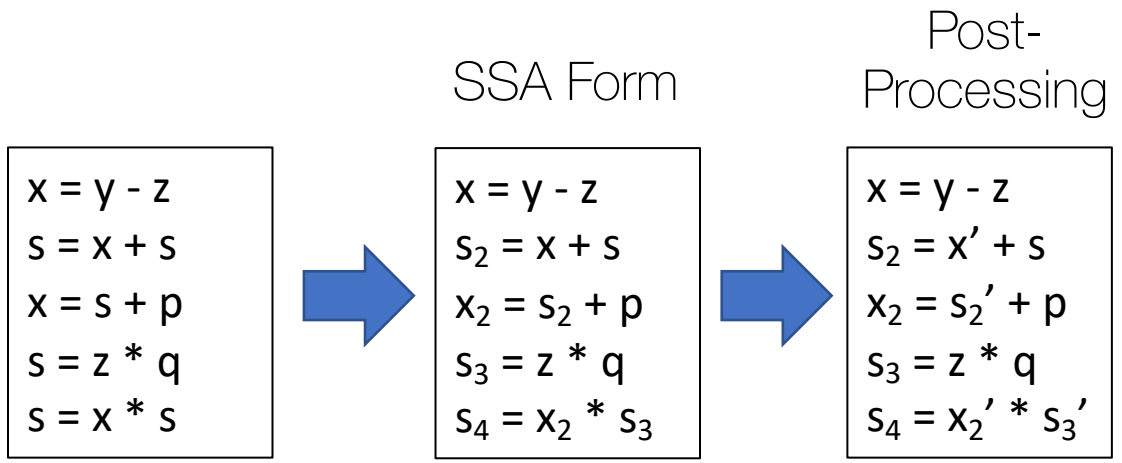
```
fun main () : int
----------------------------------------
initloc : 1
Loc 1 (at the beginning of the function 'main')
----------------------------------------
  a := 0
  b := +(1, a')
  $ret := 0
----------------------------------------
  True -> null   False -> null
```

Static Single Assignment (SSA)

- requires that each variable be assigned exactly once
- makes use-def chains explicit
  - helps to simplify optimizations
  - helps to formulate local repair (comparison with reference solution)
- enforced on a basic block level

unprimed: before assignment
primed: after assignment

For example:



If-Then-Else (ITE)

- simplifies model by merging branches if possible
- `sg.edu.nus.se.its.util.Constants.CONDITIONAL_OPERATOR`

For example:

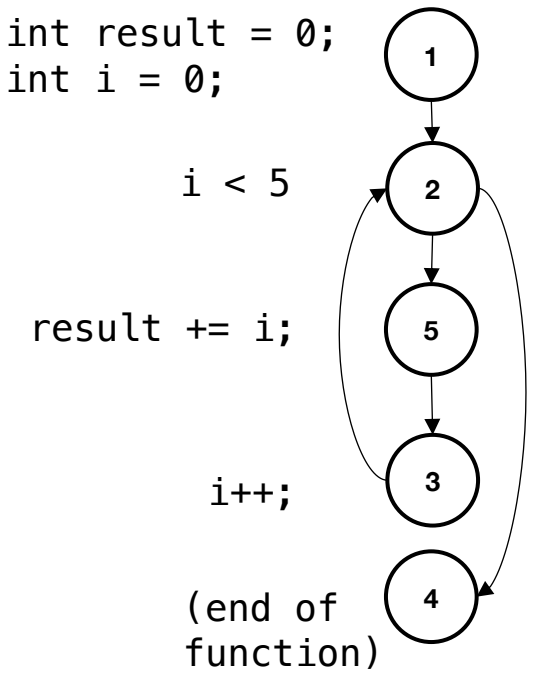
```
#include <stdio.h>
int main() {
  int a=0,b=0,c=0;
  b=1+a;
  if (b > 1) {
    c = 3;
  } else {
    c = 5;
  }
  return 0;
}
```

```
fun main () : int
----------------------------------------
initloc : 1
Loc 1 (at the beginning of the function
'main')
----------------------------------------
  a := 0
  b := +(1, a')
  c := ite(>(b', 1), 3, 5)
  $ret := 0
----------------------------------------
  True -> null   False -> null
```

its-core: Program model

(Example 2/2)

```
int main() {
    int result = 0;
    for (int i = 0; i < 5; i++) {
        result += i;
    }
}
```

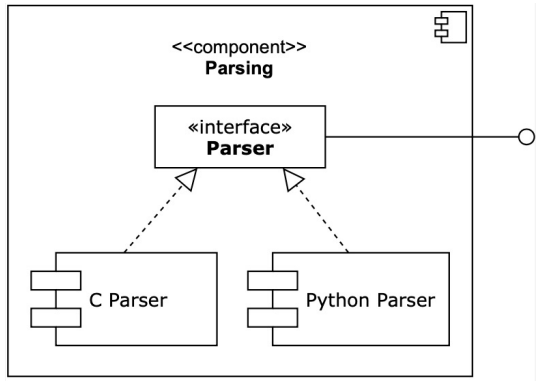



```
fun main () : int
----------------------------------------
initloc : 1
Loc 1 (at the beginning of the function 'main')
----------------------------------------
  result := 0
  i := 0
----------------------------------------
  True -> 2   False -> null
Loc 2 (the condition of the 'for' loop at line 3)
----------------------------------------
  $cond := <(i, 5)
----------------------------------------
  True -> 5   False -> 4
Loc 3 (update of the 'for' loop at line 3)
----------------------------------------
  i := +(i, 1)
----------------------------------------
  True -> 2   False -> null
Loc 4 (*after* the 'for' loop starting at line 3)
----------------------------------------
----------------------------------------
  True -> null   False -> null
Loc 5 (inside the body of the 'for' loop beginning at line 3)
----------------------------------------
  result := +(result, i)
----------------------------------------
  True -> 3   False -> null
```

its-core: Program model (Current Limitations)

- ❏ current assumption: program is compilable
- ❏ not supported yet: pointer and multi-dimensional arrays

Parser API

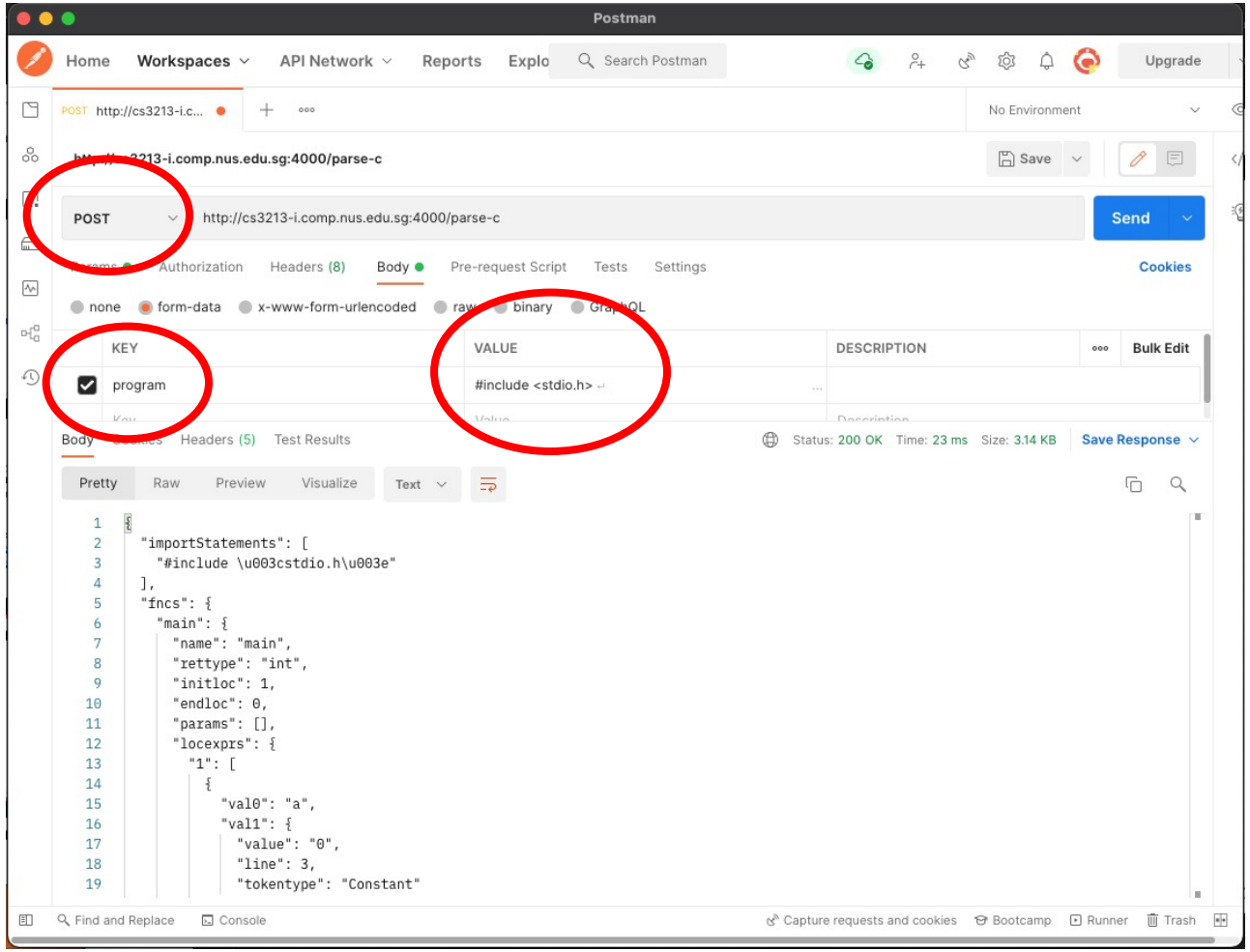


- Input: program in `.c` or `.py` source file
- Output: internal program object in `json` format
- Purpose: prepare test inputs for your test cases / evaluation

Deployed as POST service, accessible within the SoC VPN:

- http://cs3213-i.comp.nus.edu.sg:4000/parse-c
- http://cs3213-i.comp.nus.edu.sg:4000/parse-python

How to use: Parser API (1/2)



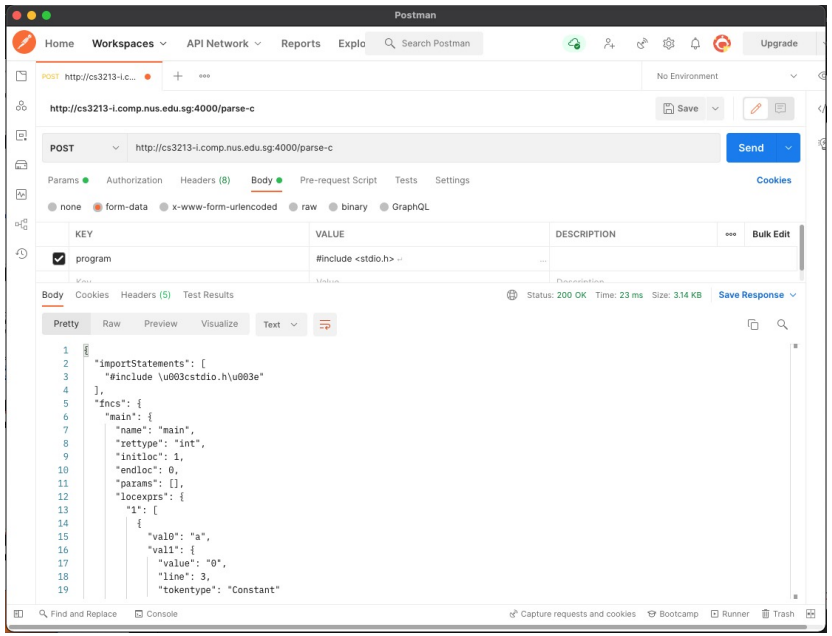
- For example, you can use the tool **Postman**[1] to send `POST` requests to our server
- `POST` body should have the *key* „`program`“ and as *value* the source code

[1] https://www.postman.com (you can use the free version)

How to use: Parser API (2/2)

```c
#include <stdio.h>
int main() {
   int a=0,b=0;
   b=1+a;
   return 0;
}
```

http://cs3213-i.comp.nus.edu.sg:4000/parse-c




```
{
  "importStatements": [
    "#include \u003cstdio.h\u003e"
  ],
  "fncs": {
    "main": {
      "name": "main",
      "rettype": "int",
      "initloc": 1,
      "endloc": 0,
      "params": [],
      "locexprs": {
        "1": [
          {
            "val0": "a",
            "val1": {
              "value": "0",
              "line": 3,
              "tokentype": "Constant"
            },
            "valueArray": [
              "a",
              {
                "value": "0",
                "line": 3
              }
            ],
            "valueList": [
              "a",
              {
                "value": "0",
                "line": 3
              }
            ]
          },
          ...
```

How to import program as `.json`

→ `sg.edu.nus.se.its.util.TestUtils`

```java
/**
 * Loads the Program model from the JSON format into the Program object.
 *
 * @param filePath - String
 * @return Program object
 */
public static Program loadProgramByFilePath(String filePath) {
  GsonBuilder builder = new GsonBuilder();
  builder.registerTypeAdapter(Expression.class, new JsonSerializerWithInheritance<Expression>());
  Gson gson = builder.create();
  File modelFile = new File(filePath);
  try {
    return gson.fromJson(new FileReader(modelFile), Program.class);
  } catch (FileNotFoundException e) {
    e.printStackTrace();
    return null;
  }
}
```

```java
@Test
void test() {
  int index = 1;
  File testFile = new File(unitTestFilePath + "c" + index + ".c");
  Program referenceProgram = TestUtils.loadProgramByFilePath(testModelPath);
  Program program = null;
  try {
    program = parser.parse(testFile);
  } catch (IOException e) {
    e.printStackTrace();
    fail();
  }
  TestUtils.programEquivalenceCheck(referenceProgram, program);
}
```

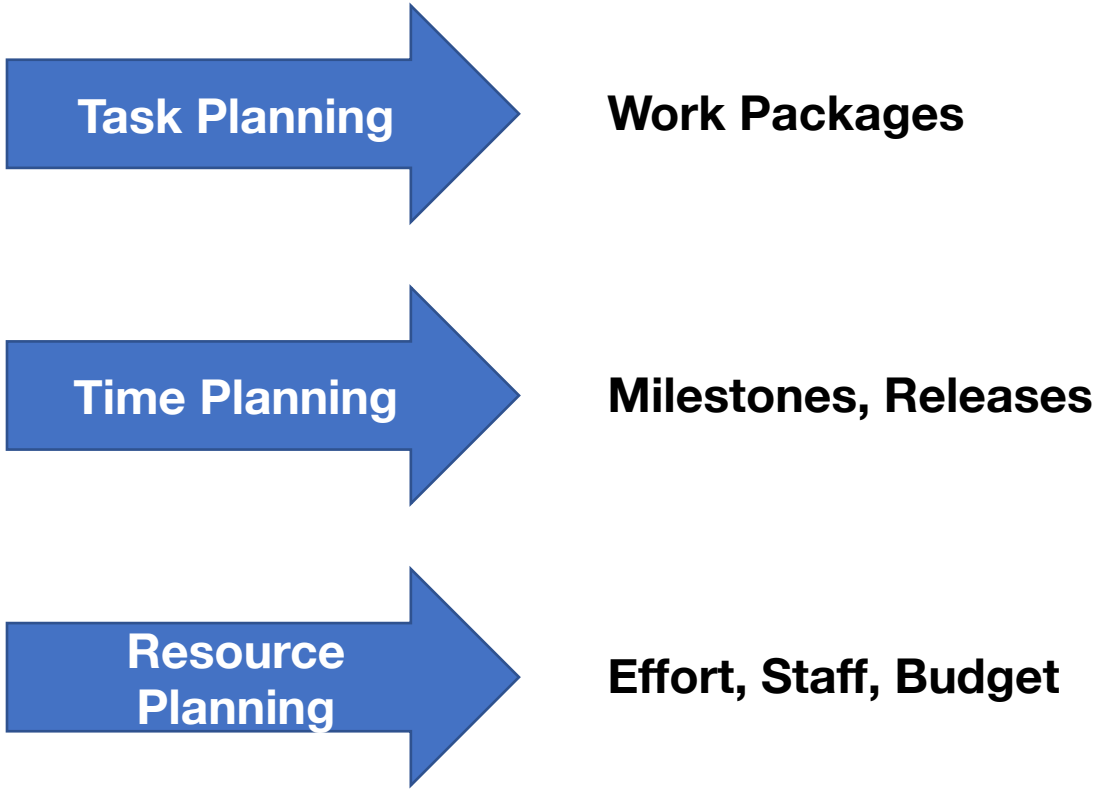
→ `sg.edu.nus.se.its.parser.BasicTest`

Any remaining question about the `Program` model or the API?

Project Management Tasks

- ❑ Product Quotation
- ❑ Project and Time Planning
- ❑ Project Cost Calculation
- ❑ Project Supervision and Review
- ❑ Selection/Hiring, Assessment, and Leading of Team Members
- ❑ Presentation and Creation of Reports
- ❑ Securing good surrounding conditions

Project Planning - Aspects



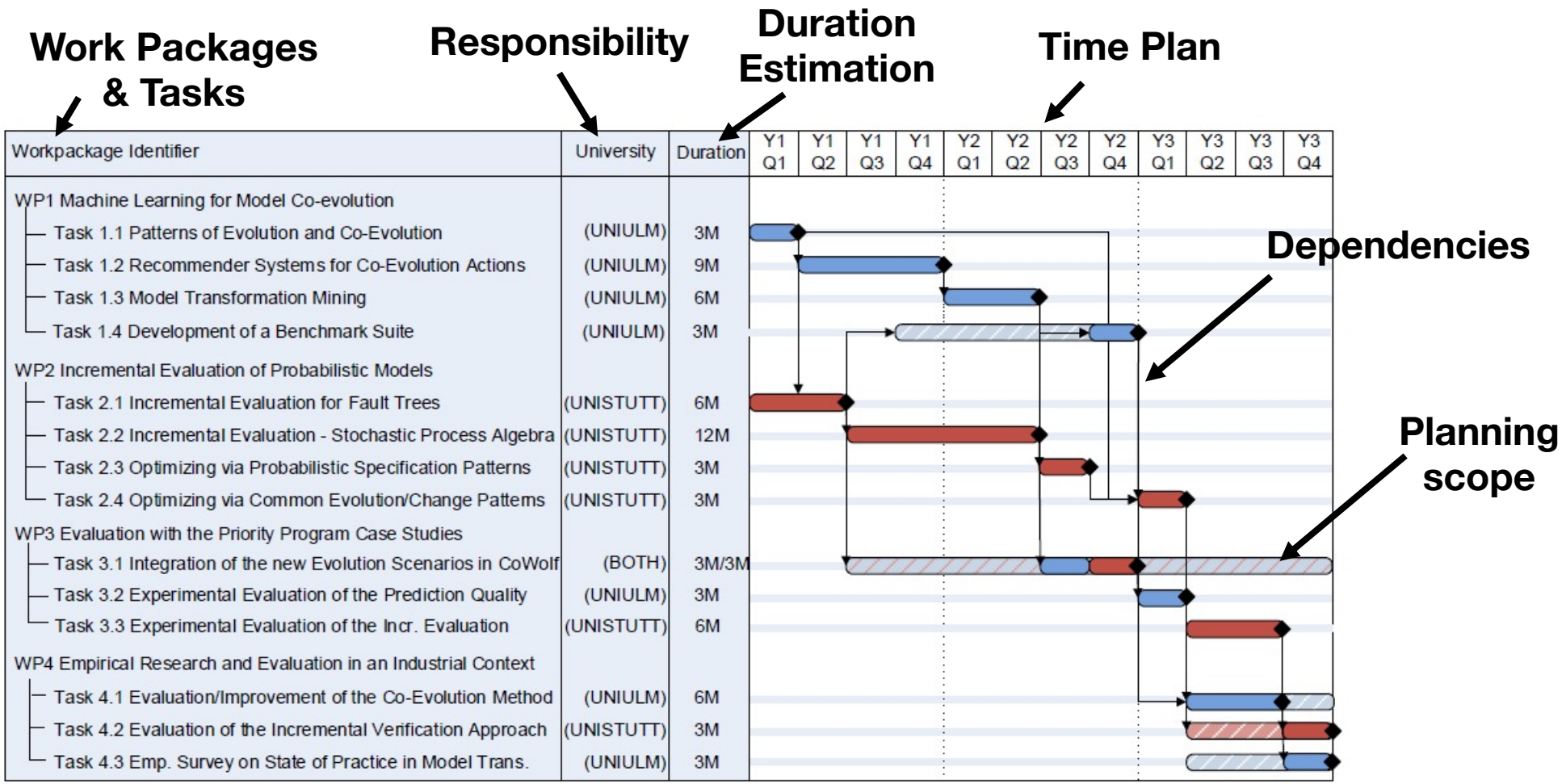
Work Packages

- **Work Package** = result & partial results
  + cost estimation
  + (after completion) real cost
- a **task** is suitable as work package if:
  - it can be done without further coordination constraint / dependency,
  - the progress and the end can be determined in an objective fashion,
  - there are events that impact the start and the end, and
  - the cost and the deadlines can be estimated.

Sample Layout

Work Package ID: a100.5	**Project:** C Parser **Phase:** Implementation	
Task:	Description Results Steps Critical Resources	
Cost:	**Plan** 3 PD (=24 hours)	**Real**
Dates: Stub xyz Module cyz …	 10/02/2022 17/02/2022 …	
Created by: YN **Authorized by:** ZF	04/12/2021 06/12/2021	

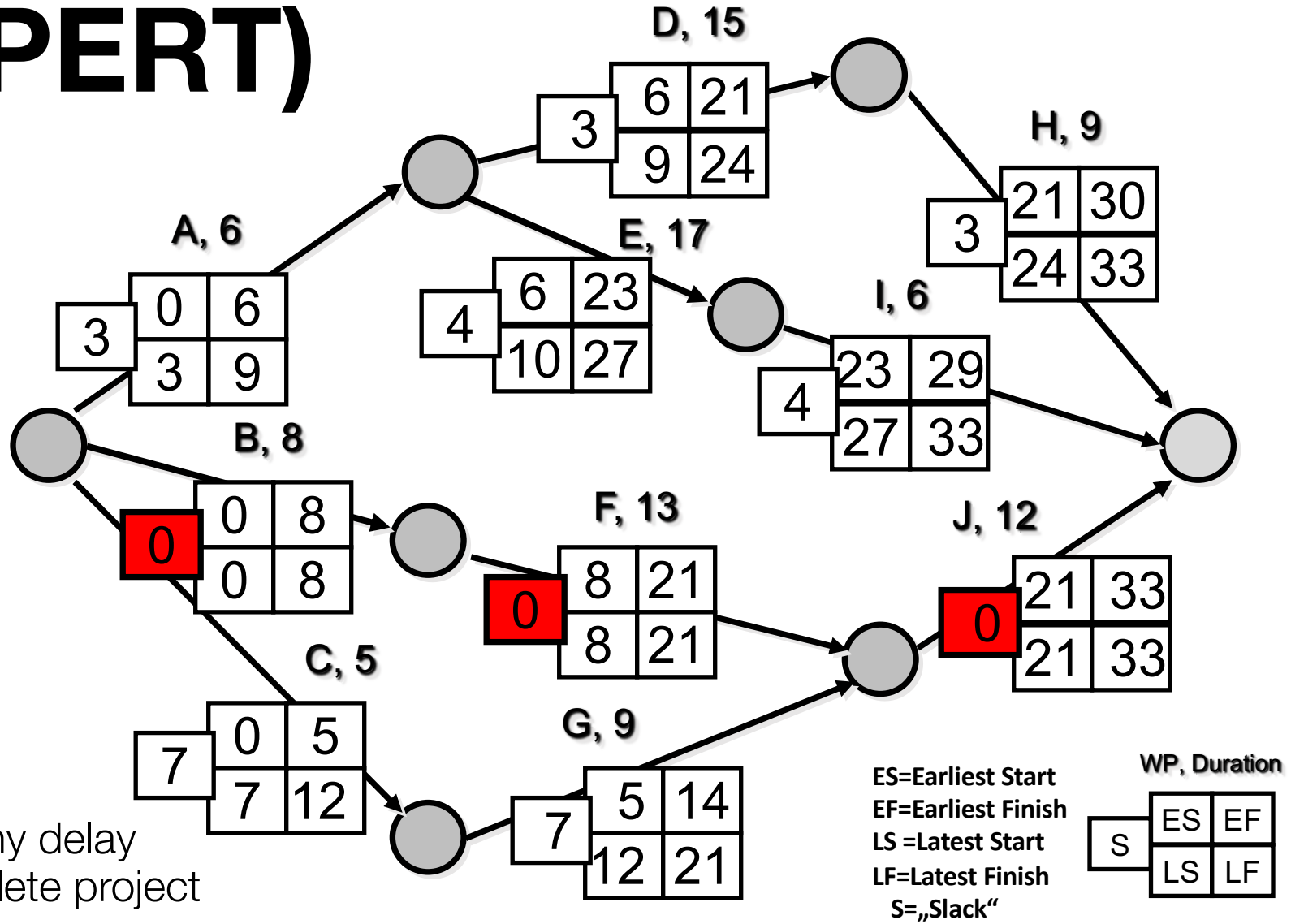
Gantt-Charts (Example)



(Example taken from a Research Project)

Program Evaluation and Review Technique (PERT)

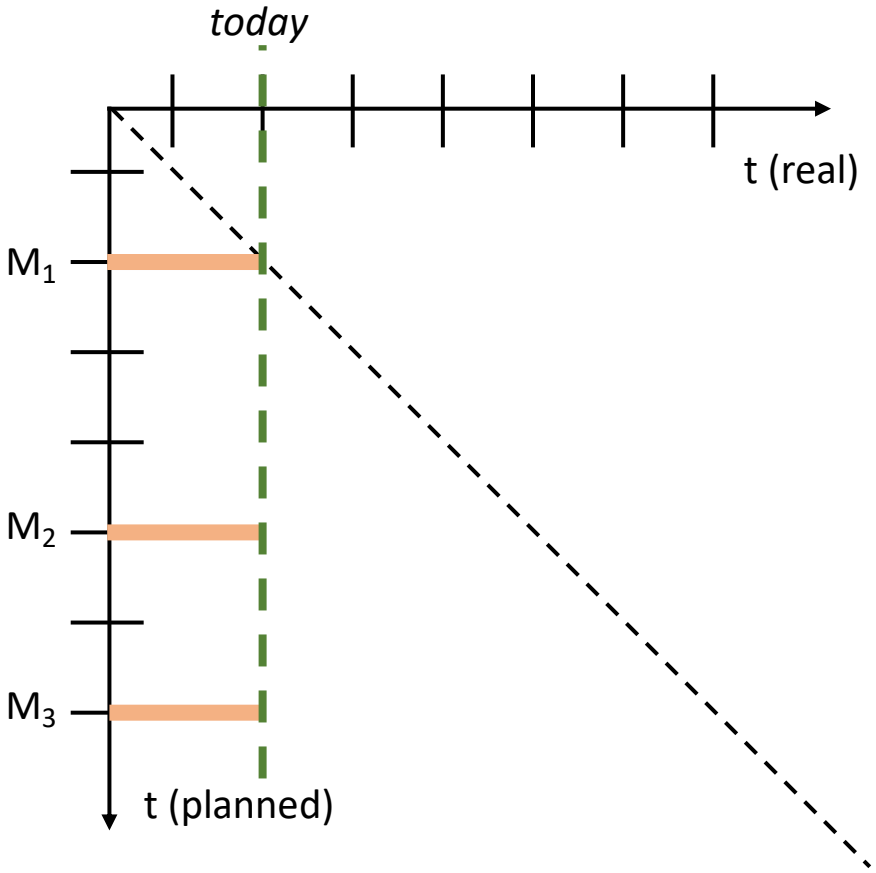
Work Package (WP)	Duration (e.g., days)	Depends on
A	6	–
B	8	–
C	5	–
D	15	A
E	17	A
F	13	B
G	9	C
H	9	D
I	6	E
J	12	F, G

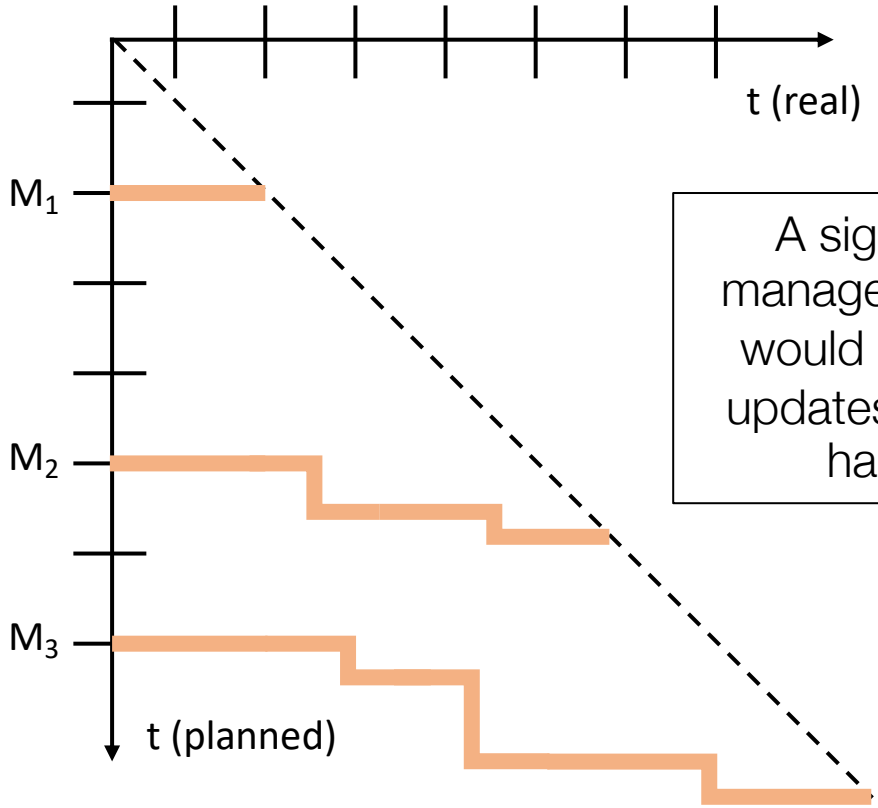


→ Identify the ***critical path***, i.e., any delay along this path will delay the complete project

Planning & Retrospective

→ **Milestone Trend Analysis (MTA)**, continuous task in project planning



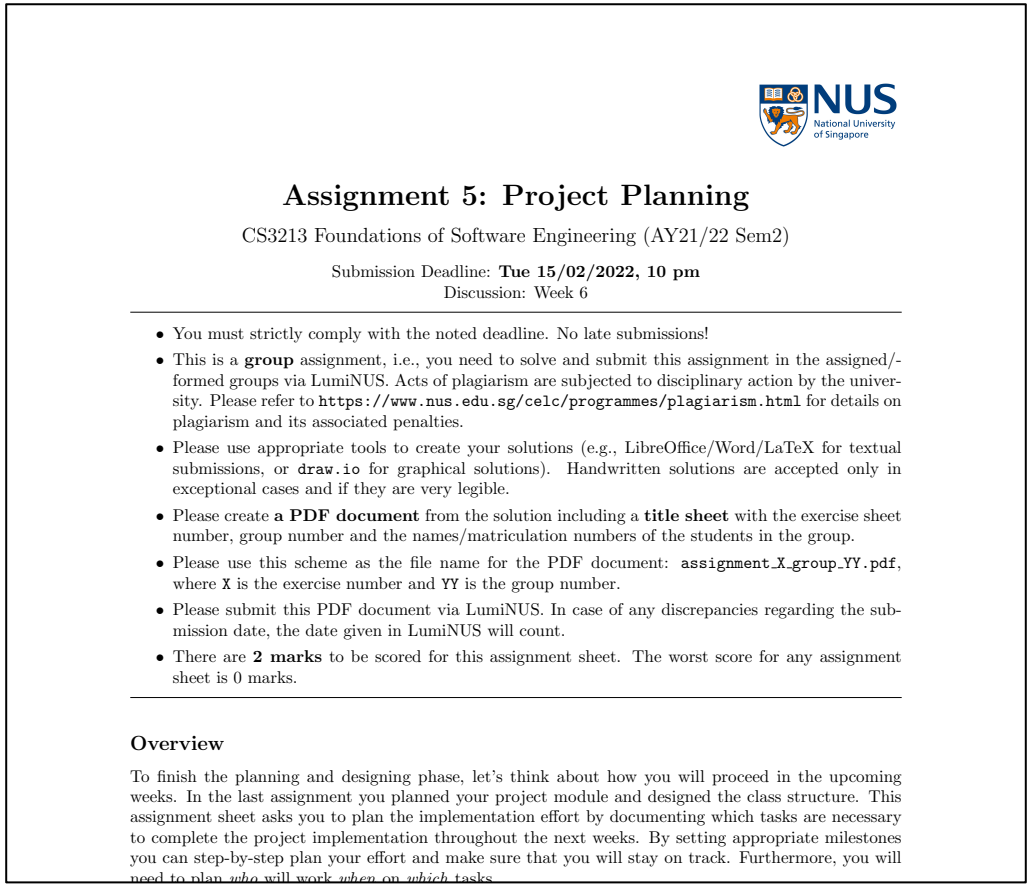


A sign of bad management skills would be a lot of updates along the half-line.

Checklist Project Planning

- ❑ Select process model
- ❑ Derive project plan
- ❑ Determine and fix milestones
- ❑ Estimate Cost (i.e., time effort)
- ❑ Resource Planning
- ❑ Duration = Time Effort / Ressources
- ❑ Planning Review (e.g., PERT)
- ❑ Check Optimizations
- ❑ Reduce Risks
- ❑ Create Gantt-Chart
- ❑ Ressource Allocation
- ❑ …

Assignment 5: Project Planning



NUS National University of Singapore

Assignment 5: Project Planning

CS3213 Foundations of Software Engineering (AY21/22 Sem2)

Submission Deadline: **Tue 15/02/2022, 10 pm**
Discussion: Week 6

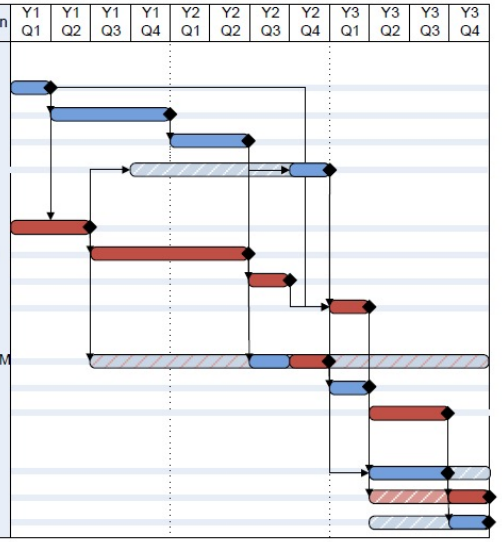
- You must strictly comply with the noted deadline. No late submissions!
- This is a **group** assignment, i.e., you need to solve and submit this assignment in the assigned/-formed groups via LumiNUS. Acts of plagiarism are subjected to disciplinary action by the university. Please refer to `https://www.nus.edu.sg/celc/programmes/plagiarism.html` for details on plagiarism and its associated penalties.
- Please use appropriate tools to create your solutions (e.g., LibreOffice/Word/LaTeX for textual submissions, or `draw.io` for graphical solutions). Handwritten solutions are accepted only in exceptional cases and if they are very legible.
- Please create **a PDF document** from the solution including a **title sheet** with the exercise sheet number, group number and the names/matriculation numbers of the students in the group.
- Please use this scheme as the file name for the PDF document: `assignment_X_group_YY.pdf`, where `X` is the exercise number and `YY` is the group number.
- Please submit this PDF document via LumiNUS. In case of any discrepancies regarding the submission date, the date given in LumiNUS will count.
- There are **2 marks** to be scored for this assignment sheet. The worst score for any assignment sheet is 0 marks.

Overview

To finish the planning and designing phase, let's think about how you will proceed in the upcoming weeks. In the last assignment you planned your project module and designed the class structure. This assignment sheet asks you to plan the implementation effort by documenting which tasks are necessary to complete the project implementation throughout the next weeks. By setting appropriate milestones you can step-by-step plan your effort and make sure that you will stay on track. Furthermore, you will need to plan *who* will work *when* on *which* tasks.

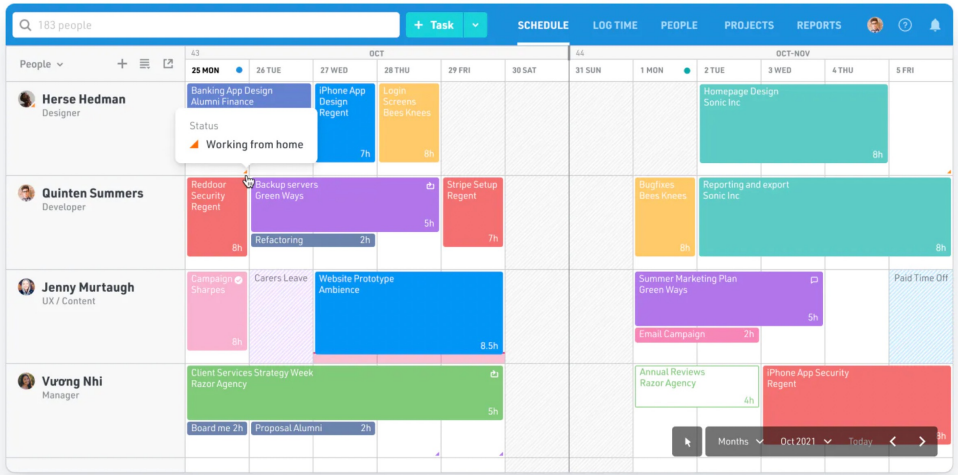
Assignment 5 – Task 1: Planning Tasks, Deadlines, Milestones

Workpackage Identifier	University	Duration
WP1 Machine Learning for Model Co-evolution		
Task 1.1 Patterns of Evolution and Co-Evolution	(UNIULM)	3M
Task 1.2 Recommender Systems for Co-Evolution Actions	(UNIULM)	9M
Task 1.3 Model Transformation Mining	(UNIULM)	6M
Task 1.4 Development of a Benchmark Suite	(UNIULM)	3M
WP2 Incremental Evaluation of Probabilistic Models		
Task 2.1 Incremental Evaluation for Fault Trees	(UNISTUTT)	6M
Task 2.2 Incremental Evaluation - Stochastic Process Algebra	(UNISTUTT)	12M
Task 2.3 Optimizing via Probabilistic Specification Patterns	(UNISTUTT)	3M
Task 2.4 Optimizing via Common Evolution/Change Patterns	(UNISTUTT)	3M
WP3 Evaluation with the Priority Program Case Studies		
Task 3.1 Integration of the new Evolution Scenarios in CoWolf	(BOTH)	3M/3M
Task 3.2 Experimental Evaluation of the Prediction Quality	(UNIULM)	3M
Task 3.3 Experimental Evaluation of the Incr. Evaluation	(UNISTUTT)	6M
WP4 Empirical Research and Evaluation in an Industrial Context		
Task 4.1 Evaluation/Improvement of the Co-Evolution Method	(UNIULM)	6M
Task 4.2 Evaluation of the Incremental Verification Approach	(UNISTUTT)	3M
Task 4.3 Emp. Survey on State of Practice in Model Trans.	(UNIULM)	3M



- create a **Gantt-Chart** showing the main tasks, their dependencies, and the milestones in your project
- break down your identified tasks to provide actionable items

Assignment 5 – Task 2: Planning Resources



- ❑ create a **resource allocation plan** to show *who* will work on *what* tasks and *when*
- ❑ the task decomposition can be more fine-grained than in the Gantt-Chart

*Note: there is **no** requirement for any specific model. For example, you can submit a **table/spreadsheet** with a detailed task decomposition and a mapping of who is working on what task when. Alternatively, you can e.g. choose a **calendar style** and show when things are done by whom.*

Any remaining question about Assignment 5?

Conclusion

- ❏ Use Parser API to prepare test inputs.
- ❏ Next step: exploring the **solution space → start implementation**

Next Lecture (Project-Part) – Week 6:
Implementation & Intermediate Deliverable (A6)

- ➢ Discussion Implementation (Clean Code) & Testing
- ➢ Assignment 6: Intermediate Deliverable (Content + Grading)