

Responsible teacher: Jan Carlson 021-151722

**Help allowed: Calculator, ruler and language dictionary**

Max points: 40

Approved: Minimum 20 points

**Grade 5:** 34 – 40 p

**Grade 4:** 27 – 33.9 p

**Grade 3:** 20 – 26.9 p

**Grade A:** 36 – 40 p

**Grade B:** 32 – 35.9 p

**Grade C:** 27 – 31.9 p

**Grade D:** 23 – 26.9 p

**Grade E:** 20 – 22.9 p

Write on one side of the sheet only! Answer in English or Swedish.

Assumptions must be made when there is not enough information provided to solve an assignment, and all assumptions must be specified and explained in order to achieve full points.

**Good luck!**

## Assignment 1: Project planning (8 p)

Your company has two ongoing projects (to develop systems A and B). For both projects, the initial requirements elicitation and formulation has been done, and it is now time to plan the rest of the activities. System A is safety-critical and requires extensive testing. In addition to the actual test activity, an explicit activity (AP) is defined for writing a test plan and defining test cases.

The following activities and effort estimations have been identified:

System	Activity	Effort (person days)
A	AD Design	50
	AP Test planning	30
	AI Implementation	120
	AT Test	60
B	BD Design	20
	BI Implementation	50

The whole development team consists of ten persons, and it has been decided that no more than six persons should work on any activity, to avoid the communication overhead of larger groups. Moreover, each activity should have the same persons involved from start to finish.

System A is the urgent, so although you should avoid unnecessary delays to B, the main focus should be to deliver A as soon as possible.

List all dependencies between the activities. Describe how team members are allocated to activities, and the resulting duration of each activity. Make a Gantt chart showing when the activities will happen in time (including both projects in the same chart). Durations and dependencies should also be clearly visible in the Gantt chart.

*Hint: It is ok to round off durations to integers (effort values are just estimates).*

## Assignment 2: Agile and Scrum (9 p)

- a) Describe the main advantage of *agile development* over *plan-based* and explain why. Also, describe one negative aspect of agile. (3 p)
- b) Describe the Scrum event *Sprint planning*, including participating roles and artefacts involved. (4 p)
- c) Explain the difference between *Continuous Integration* and *Continuous Delivery*. (2 p)

## Assignment 3: Software architecture (8 p)

- a) Software architecture is not a main focus in agile development, but architectural decisions tend to have a significant impact on quality. Explain why many agile projects succeed in delivering high quality software even though very little effort was spent on architectural decisions. (2 p)
- b) Explain the difference between layers in a layered architecture and tiers in a tiered architecture. What are the main benefits of a layered architecture, and what are the additional benefits of a tiered architecture? (6 p)

## Assignment 4: State machine diagram (6 p)

Your task is to model the behavior of the espresso machine at the Computer Science and Software Engineering division, or at least a part of it, in a UML state machine diagram. The machine can make single or double espressos (although the double is just two single espressos brewed after each other). The brewing starts when the button is pressed, and if it is pressed again before the brewing is done, the machine should make it a double (meaning that brewing should start again when the current brewing finishes). A display indicates if the machine is ready, brewing a single espresso or a double.

Use the following events and actions in the diagram:

Events	Actions
Button_pressed	Start_brewing
Brewing_done	Display_ready
	Display_single
	Display_double



## Assignment 5: Testing (9 p)

- Describe one benefit of *code reviews* compared to testing. (2 p)
- Explain the following concepts: *unit testing*, *integration testing* and *acceptance testing*. (3 p)
- In a system controlling the movement of a truck bed, we have the following function:

```
int computeMotorSpeed(int pos, int dir)
```

The function computes the correct motor speed (from -20 to 20), depending on the position of the truck bed (represented by integers from 0 to 90, where 0 is the lowest position and 90 the highest position of the truck bed) and the direction of the driver joystick (-1, 0 or 1 representing down, neutral and up).

If the truck bed is in an end position, the motor will not continue in that direction. If it is within 10 position steps from an endpoint, the motor is only allowed to run at low speed (between -5 and 5), but in the other positions it can run faster (-20 to 20). If something is wrong, the output should be 255.

Describe how you would select good black-box test cases for this function, and exemplify with concrete test case inputs. (4 p)