Software Engineering

WS 2024/25, Assignment 01

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Organizational Section:

- The assignment must be accomplished by yourself. You are not allowed to collaborate with anyone. Plagiarism leads to failing the assignment.
- The deadline for the submission is fixed. A late submission leads to a desk reject of the assignment.
- Your submission must consist of a *ZIP* archive containing the folliwng files:
  - `Assignment.pdf` – The PDF file containing the solutions for all tasks, **including** the rendered feature models for the first two tasks.
  - `laptop.uvl` – The feature model for *Task 1* in UVL notation.
  - `ps.uvl` – The feature model for *Task 2* in UVL notation.
- The PDF file included in your submission must fulfil the following criteria:
  - You used the LaTeX template provided in the materials section on the course's CMS page.
  - Your name and matriculation number are included as specified by the template.
  - No screenshots or photos of handwritten solutions will be accepted.
- Any violation of these submission format rules leads to a desk reject of the assignment.
- Questions regarding the assignment can be asked in the forum or during tutorial sessions. Please do not share any parts that are specific to your solution, as we will have to count that as attempted plagiarism.
- If you encounter any technical issues, inform us immediately.
- It is **required** to use UVL to create the feature models for the first two tasks. We strongly recommend to use the VS Code extension to create the feature models and export them to **dot** files, which can easily be embedded in the provided LaTeX template.
  - **Note:** The UVL plugin of VS Code will preview and export the feature diagrams automatically in a dark theme. Due to that, *mandatory* nodes are rendered as *filled white circles*, while *optional nodes* are rendered as *hollow white circles* (Which appear to be filled with black)
  - While this may seem "opposite" to how this is shown in the lecture slides, it is still correct and just an artefact of the dark mode.

Task 1 [5 Points]

Create a feature diagram for the laptop product line presented in in Table 1 in UVL.
The features correspond to the hardware listed in the laptop variants. Include all crosstree constraints in addition to the feature diagram. The feature diagram must model *exactly* the possible laptops listed in the table. That means, it must not leave out any of the listed laptops and it must not include any additional laptops. The hard- and software, as well as any additional purchasable packages, should be modeled as features.

Whereever possible use the appropriate structural elements (OR/XOR groups, optional and mandatory features) to model the product line. Your model **must not** use more than **three** cross-tree constraints. Each cross-tree constraint **must not** contain more than **four** individual features.

Task 2 [4 Points]

Create a feature diagram (including cross-tree constraints) for the command line tool PS in UVL. Your model has to include all features and constraints that are included in the *simplified man-page* of the tool given in Figure 3.

Whereever possible use the appropriate structural elements (OR/XOR groups, optional and mandatory features) to model the product line. Your model **must not** use more than **two** cross-tree constraints. Each cross-tree constraint **must not** contain more than **two** individual features.

Task 3 [4.5 Points]

a) Convert the abstract syntax in Figure 1 of the command-line tool TAR into a propositional formula, following the definition of the lecture. [3 Points]

b) For the propositional formula from task 3a), propose one *generalization*, one *specialization* and one *refactoring*.

Note: You do not have to write the entire formula again. It suffices to only *write down the old and new versions of the clause(s)* you changed. [1.5 Points]

$$
\begin{aligned}
fn \;= \bigstar\langle\!\langle \wedge\langle\!\langle\, \text{TAR}, \\
&\bullet\langle\!\langle\, \text{TAR},\ \blacktriangle\langle\!\langle\, OpMode, Create, Delete, \wedge\langle\!\langle\, Extract, \circ\langle\!\langle\, Extract, Touch \,\rangle\!\rangle \,\rangle\!\rangle \,\rangle\!\rangle, \\
&\bullet\langle\!\langle\, \text{TAR},\ \triangle\langle\!\langle\, Format, Gnu, Posix \,\rangle\!\rangle \,\rangle\!\rangle, \\
&\circ\langle\!\langle\, \text{TAR},\ \blacktriangle\langle\!\langle\, Options, Interactive, Owner, RemoveFiles \,\rangle\!\rangle \,\rangle\!\rangle, \\
&\bullet\langle\!\langle\, \text{TAR}, Archive \,\rangle\!\rangle, \\
&\circ\langle\!\langle\, \text{TAR}, File \,\rangle\!\rangle, \\
&\rangle\!\rangle \,\rangle\!\rangle
\end{aligned}
$$

Figure 1: The abstract syntax of TAR

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Task 4 [6.5 Points]

a) Derive the abstract syntax for the feature diagram in Figure 2 that models the menu of a burger shop. [4.5 Points]

b) Give two *valid* configurations for the burger menu in *functional* notation [0.5 Points]

c) Give two *valid* configurations for the burger menu in *set* notation [0.5 Points]

d) Give four *invalid* configurations for the burger menu in *formula* notation [1 Points]

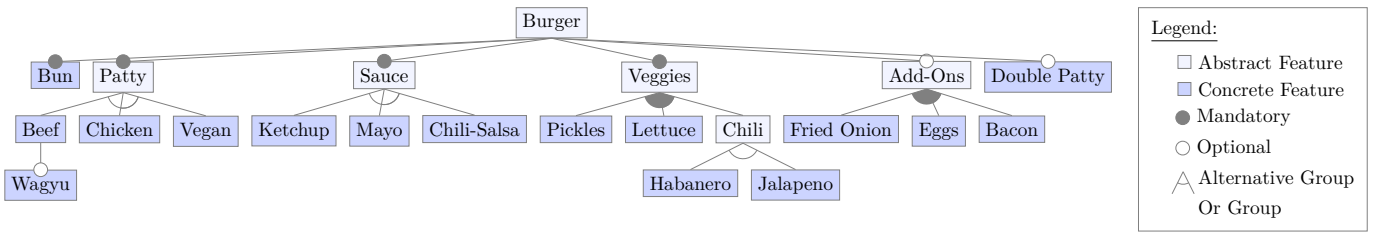

Figure 2: Feature Diagram of a Burger Menu

PS Manpage (simplified)

Name

`ps` - report a snapshot of the current processes.

Description

`ps` displays information about a selection of the active processes. If you want a repetitive update of the selection and the displayed information, use top instead.

Program Information

The options listed below display basic information about the installed `ps` program. Can be added in addition to all other option groups.

`--help`
: Print a help message. Cannot be combined with `--version`

`-V, --version`
: Print the installed `ps` version.

`--info`
: Print debugging Info

Process Selection

The options listed below describe how `PS` selects processes to display. Options can be combined freely, unless specified otherwise. At least one process selection option has to be present at all times.

`--all`
: Show all processes.

`-G, --Group {NAME|RGID}`
: Select processes by group. Group can be specified by **real group ID (RGID)** or **name**.

`-C`
: Select processes by command name.

`-p, --pid`
: Select process by ID.

Output Format

The options listed below specify the output format of the selected processes. At most one output format can be selected at a time.

`-j`
: Display jobs-oriented format.

`-f [-L]`
: Do full-format listing. This also causes the command arguments to be printed. The optional `-L` flag adds additional columns for thread information.

`-u`
: Display user-oriented format.

`-l`
: Long Format.

Output Modifiers

The options below can be used to fine-tune the output. Unless specified otherwise, they can be freely combined with each other and with options from other option groups.

`--cols`
: Set screen width

`--rows`
: Set screen height

`--forest`
: ASCII art process tree

`--headers`
: Repeat header lines, one per page of output.

`-y`
: Do not show flags. This option can only be used with `-l`

Figure 3: The simplified Manpage of PS.

Table 1: This table lists all possible laptops, no other combination is possible.

Model					**Price**	
					14”	16”
NagBook B 8GB	14” Screen	L3 Processor	8 GB DDR6 RAM	SATA SSD 512 GB	$799	—
NagBook B 16GB	14” Screen	L3 Processor	16 GB DDR6 RAM	SATA SSD 512 GB	$1099	—
NagBook B 32GB	14” Screen	L3 Processor	32 GB DDR6 RAM	SATA SSD 512 GB	$1199	—
NagBook M 8GB	14” Screen	L3 Processor	8 GB DDR6 RAM	NVMe SSD 1 TB	$999	—
NagBook M 16GB	14” Screen	L3 Processor	16 GB DDR6 RAM	NVMe SSD 1 TB	$1299	—
NagBook M 32GB	14” Screen	L3 Processor	32 GB DDR6 RAM	NVMe SSD 1 TB	$1399	—
NagBook MD 8GB	14” Screen	L3 Processor	8 GB DDR6 RAM	NVMe SSD 2 TB	$1199	—
NagBook MD 16GB	14” Screen	L3 Processor	16 GB DDR6 RAM	NVMe SSD 2 TB	$1299	—
NagBook MD 32GB	14” Screen	L3 Processor	32 GB DDR6 RAM	NVMe SSD 2 TB	$1399	—
NagBook P 16GB	14” or 16” Screen	L3 Pro Processor	16 GB DDR6 RAM	SATA SSD 512 GB	$1299	$1499
NagBook P 32GB	14” or 16” Screen	L3 Pro Processor	32 GB DDR6 RAM	SATA SSD 512 GB	$1599	$1699
NagBook SP 16GB	14” or 16” Screen	L3 Pro Processor	16 GB DDR6 RAM	NVMe SSD 1 TB	$1499	$1699
NagBook SP 32GB	14” or 16” Screen	L3 Pro Processor	32 GB DDR6 RAM	NVMe SSD 1 TB	$1799	$1949
NagBook SPBD 16GB	14” or 16” Screen	L3 Pro Processor	16 GB DDR6 RAM	NVMe SSD 2 TB	$1699	$1899
NagBook SPBD 32GB	14” or 16” Screen	L3 Pro Processor	32 GB DDR6 RAM	NVMe SSD 2 TB	$1999	$2299
NagBook U 16GB	14” or 16” Screen	L3 Ultra Processor	16 GB DDR6 RAM	SATA SSD 512 GB	$1999	$2199
NagBook U 32GB	14” or 16” Screen	L3 Ultra Processor	32 GB DDR6 RAM	SATA SSD 512 GB	$2199	$2499
NagBook SU 16GB	14” or 16” Screen	L3 Ultra Processor	16 GB DDR6 RAM	NVMe SSD 1 TB	$2099	$2299
NagBook SU 32GB	14” or 16” Screen	L3 Ultra Processor	32 GB DDR6 RAM	NVMe SSD 1 TB	$2299	$2599
NagBook SUBD 16GB	14” or 16” Screen	L3 Ultra Processor	16 GB DDR6 RAM	NVMe SSD 2 TB	$2199	$2399
NagBook SUBD 32GB	14” or 16” Screen	L3 Ultra Processor	32 GB DDR6 RAM	NVMe SSD 2 TB	$2499	$2699
NagBook Max	16” Screen	L3 Ultra Processor	64 GB DDR6 RAM	NVMe SSD 2 TB	—	$2999
Creative Package Add-Ons:						
Photo Editor						$250
Video Editor						$300
3D Animator						$350
Cloud Sync	*(Requires Photo Editor)*					$100
Device Insurance	• Insurance for 24 months • Covers Device Damage • Covers Theft				10% of device price	