Software Engineering

WS 2021/22, Sheet 08

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Task 1

Consider a configurable system with 20 optional features, 10 of which interact pairwise.

a) How many glue-code modules are necessary to resolve all interactions?

b) How many glue-code modules are necessary if each feature interacts with any other feature?

c) How many products does the configurable system have if interacting modules cannot be selected independently from each other?

Solution

a) There are 5 pairs of interacting features $\rightarrow$ five glue-code modules

b) One glue-code module for each pair of features; Number of pairs: $\binom{20}{2} = 190$

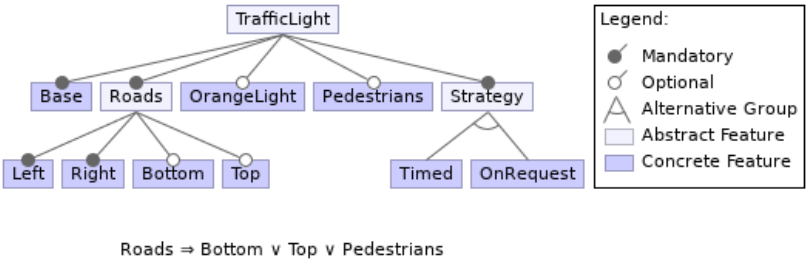
c) Before: 2^{20} variants
Now: 10 non-interacting optional features + 5 (optional) pairs of features $\rightarrow 2^{10+5} = 2^{15}$ variants

Task 2

Consider the following feature model of an intersection managed by traffic lights given below.

a) Which features in the model interact with each other?

b) How could these interactions be resolved?



Roads ⇒ Bottom ∨ Top ∨ Pedestrians

Base	Contains the base functionality that is included in all variants.
Roads	The sub-features of this feature determine from which directions roads lead to the intersection. Each road automatically has a traffic light at the intersection. Traffic lights of opposing roads (e.g., left and right) always show the same light.
OrangeLight	Adds an orange light to traffic lights. Pedestrian traffic lights do **not** get an orange light.
Pedestrians	Adds pedestrian traffic lights to each road that is present in the configuration. Pedestrian lights are green if the traffic light on the same road is red, and red otherwise.
Strategy	The sub-features determine how the traffic lights behave.
Timed	The *Left*/*Right* roads start with a green phase. After some time, the traffic lights switch and the *Bottom*/*Top* roads get green phase before the traffic lights switch again and the cycle repeats.
OnDemand	The *Left*/*Right* roads are green by default. When a vehicle queues at one of the *Bottom*/*Top* roads or a pedestrian queues at the *Left*/*Right* roads, the traffic lights switch to a green phase on the *Bottom*/*Top* roads, and then switches back.

Solution

Interacting Features	**Reason**	**Resolution**
Left|Right|Bottom|Top • Pedestrians	Pedestrians can queue at each road	Road as concrete feature gets modified by Pedestrians; Road Subfeatures just add new instances of Road
OrangeLight • Timed|OnRequest	Orange lights influence how traffic lights have to switch	When to switch: Timed/OnRequest; How to switch: OrangeLight
Bottom|Top|Pedestrian • OnRequest	Switching strategy must check if vehicles/pedestrians are queued	Introduce interaction feature(s)

Task 3

Given the following scenario, discuss whether feature interactions are always undesired:

Consider a telephone system. Alice redirects calls to Bob; Bob redirects calls to Carol. If Alice gets called, should the call be redirected to Carol?

Solution

There are three possible solutions to resolve the feature interaction:

Solution 1 Forbid the second redirect.

Solution 2 Allow the second redirect.

Solution 3 Add an interaction-feature that lets the user can choose between the other two solutions.

Insert your own discussion about what solution is preferred when here

Task 4

Draw a Venn diagram that visualizes the feature interactions in the code example below. The dots in the example stand for feature code.

```
#ifdef A
...
#endif

#ifdef B
...
#if defined(A) && defined(C)
...
#endif
#endif

#ifdef C
#ifdef A
...
#endif
...
#endif

#ifdef D
...
#endif
```

Solution