Model Checking WS 2011: Assignment 7

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Exercise 25

Given a hash function that always returns the same constant hash value. How many collision list elements have to be visited altogether if \( n \) objects with different keys are inserted into a hash table with collision chains? Justify your answer and illustrate your solution with a drawing.

Exercise 26 (compare with Exercise 21 from Assignment 6)

![Graph](image_url)

Apply non-recursive DFS (see slides 56, 57) on the given graph with states \( S := \{1,2,\ldots,12\} \) where the *state cache is implemented using bit state-hashing* with one hash function \( h \) as follows.

Let \( h : S \rightarrow \{0,1,\ldots,15\} \) be a hash function which maps a state \( s \in S \) to a 4-bit hash value where \( h(s) := (2 \cdot s + 2) \mod 16 \). Value \( h(s) \) is used to index a hash table with \( 2^4 = 16 \) 1-bit entries \( b_0, b_1, \ldots, b_{15} \). Before DFS starts all \( b_i \) are set to 0.

Report the contents of cache (i.e. what \( b_i \) are set to 1) and stack and the value of current at the end of each iteration of the while-loop. Use the convention that states with larger ID are always pushed first on the stack, e.g. for initial states 1 and 4, 4 is pushed before 1. Assume that state 11 is the only bad state: is_target(11) is true and false otherwise.
Exercise 27

Let $A_1, A_2$ and $A_3$ be LTS defined as follows:

- $A_1 := (\{1, 2\}, \{1\}, \{a_1, t, s\}, \{(1, a_1, 2), (2, t, 1), (1, s, 2)\})$.
- $A_2 := (\{1, 2, 3\}, \{1\}, \{a, b, t\}, \{(1, b, 2), (2, a, 3), (3, t, 1)\})$.
- $A_3 := (\{1, 2\}, \{1\}, \{t, s\}, \{(1, s, 2), (2, t, 1)\})$.

Determine the set of local and global symbols for $A_1 || A_2 || A_3$ and each component LTS and draw the LTS for $A_1 || A_2 || A_3$.

Exercise 28

a) Given LTS $A_2$ from Exercise 27 and LTS $A_1 := (\{1, 2\}, \{1\}, \{a_1, t\}, \{(1, a_1, 2), (2, t, 1)\})$, draw the LTS for $A_1 ||| A_2$.

b) Why is the requirement $\Psi(a) \neq \emptyset$ in the definition of transitions in the asynchronous composition of multiple LTS necessary? Give a concrete example where the semantics will differ if this requirement is dropped.