02157 Functional Programming - Assignment 2

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Task 1

1.

```
type T = | A of T list
         | B of bool
         | C of T*T
```

2.

Rules for generating values of type `T`:

1. If a list $[t_1; t_2; ...; t_n]$ is of type `T list` then the tree `A` is a member of `T`.
2. For every boolean `b`, the tree `B` is a member of `T`.
3. If t_1 and t_2 in (t_1, t_2) are of type `T`, then the tree `C` is a member of `T`. 4. The tree `T` contains no other values than the trees generated by Rules 1, 2 and 3.

3.

In this section it is going to be shown how the rules defined are going to be used to generate values of T.

Value 1: `A []`

Step a: The tree `A []` is a member of T by Rule 1.

Value 2: `B true`

Step a: The tree `B true` is a member of T by Rule 2.

Value 3: `C(A [B false; B true],B true)`

Step a: The tree `B false` is a member of T by Rule 2.
Step b: The tree `B true` is a member of T by Rule 2.
Step c: The tree `A [B false; B true]` is a member of T by Step a and Step b and Rule 1.
Step d: The tree `C(A [B false; B true],B true)` is a member of T by Step c, Step b and Rule 3.

Value 4: `C(A [B true; C(A [B true],B true);B false], A [B true; C(A [B true],B true);B false])`

Step a: The tree `B false` is a member of T by Rule 2.
Step b: The tree `B true` is a member of T by Rule 2.
Step c: The tree `A [B true]` is a member of T by Step b and Rule 1.
Step d: The tree `C(A [B true],B true)` is a member of T by Step c and Step b and Rule 3.
Step e: The tree `A [B true; C(A [B true],B true);B false]` is a member of T by Step b, Step d, Step a and Rule 1.
Step f: The tree `C(A [B true; C(A [B true],B true);B false], A [B true; C(A [B true],B true);B false])` is a member of T by Step e and Rule 3.

4.

Figure 1: Value 1

Figure 2: Value 2

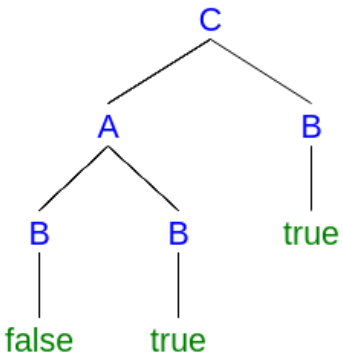

Figure 3: Value 3

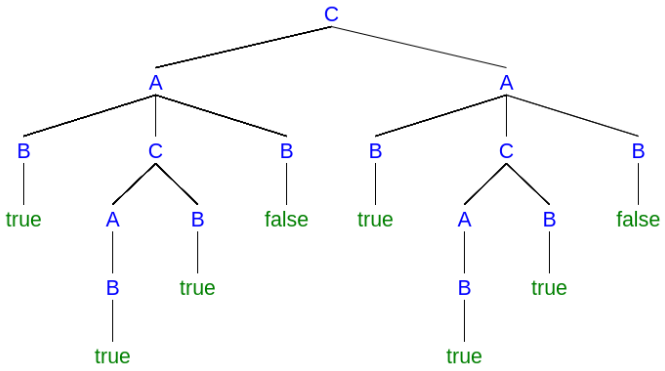

Figure 4: Value 4