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Multiway Dataflow Constraint System and UI Programming

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Chapter 1

Introduction

This report is part of my INF319 project at the University of Bergen (UiB). The goal of the project was to understand event-based Graphical User Interface (GUI) programming and the limitation to such programming. Specify dataflow constraints and understand how they connect to GUI widgets. Understand the possibilities and limitations of constraint systems based on GUIs. The multiway dataflow constraint system used in the development of this project is HotDrink. Before developing this project I had no prior experience with HotDrink.

TODO: Skriv hva rapporten inneholder.

1.1 Constraint systems

A constraint system can be seen as a tuple $\langle V, C \rangle$, where V is a set of *variables* and C a set of *constraints*. Each variable in V has a associated value of a given type (string, integer, boolean, object, etc.). Each constraint in C is a tuple $\langle R, r, M \rangle$. The variables involved in the constraint is given by $R \subseteq V$, r is some n -ary relation among variables in R , where $n = |R|$. M is a set of non-empty set of *constraint system methods*. Executing any method m in M enforces the constraint by computing values for some subset of R , using another disjoint subset of R as inputs, such that the relation R is satisfied [4].

1.2 HotDrink

In this project I used the multiway dataflow constraint system library HotDrink [3], which is a JavaScript-based library for multiway dataflow constraint systems in GUIs. Instead of writing explicit event handlers, the programmer writes declarative specification of data dependencies, from which the library derives the GUI behavior. This library features a DSL for defining constraint systems. The DSL allows one to specify *components*, *constraints*, *methods* and *variables*. A component in HotDrink holds a set of constraints and variables, as described in section 1.1. Variables often depend on each other, in that case it gets into a setting of multi-way dataflow.

The HotDrink DSL is implemented JavaScript tagged template literals¹, which can be seen in Listing 1.1. This lets the programmer integrate the library with frontend JavaScript frameworks such as React² and Svelte³.

Listing 1.1: Example of the HotDrink DSL

```
1 import { component } from 'hot-drink';
2
3 const comp = component`
4   var f=1337, c;
5
6   constraint c1 {
7     m1(c -> f) => c * (9/5) + 32;
8     m2(f -> c) => (f -32) * 5/9;
9   }
10 `;
```

¹Template literals

²For more information about the framework can be found at reactjs.org

³For more information about the framework can be found at svelte.dev

1.3 Svelte

Svelte is a JavaScript framework used for building user interfaces, just like React, Angular, Vue. Where some of these frameworks bulk there work in the browser, Svelte shifts that work onto a compile step [2]. Svelte is written using TypeScript. Instead of using virtual Document Object Model (DOM) svelte uses build time to covert the code into JavaScript [1].

List of Acronyms and Abbreviations

DOM Document Object Model.

DSL Domain Specific Language.

GUI Graphical User Interface.

UiB University of Bergen.

Bibliography

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