Structure of Programming Languages I: Denotational Semantics

Assignments

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Please return the completed results by February 1. Put them in an envelope, address it to me, and put it into some university mail box. If there are problems, feel free to contact me per email. Do not forget to denote your name, Matrikelnummer and Studienkennzahl (SKZ).

1. Design the input language of a vending machine that sells various articles at various prices.

   (a) The user selects an item by entering a numerical code digit by digit.

   (b) After the selection, the vending machine displays the price of the selected article or "not available", if the article is not in stock.

   (c) If the machine may not return change on overpayment from its current deposit of coins, it adds "cannot change" to the display.

   (d) The user pays the article by entering coins of various values. If the total value reaches the price of the article, the article is dispensed.

   (e) If the article was overpaid, the machine returns the exact change from its deposit (as far as it can do so).

   (f) At any time in the transaction (entering the code, entering the coins), the user may abort the transaction by hitting an abort key; the machine returns all the money entered so far.

   Define semantic algebras, abstract syntax, and valuation functions.

2. Define the denotational semantics of a command

   ```
   swap I_1, I_2
   ```

that interchanges the values of its two variables. Define the denotational semantics of a "parallel" assignment

```
I_1, I_2 = E_1, E_2
```

(for any number of components) and prove the equivalence of the swap command to

```
I_1, I_2 = I_2, I_1
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