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Theoretisches Aufgabenblatt 8

Abgabetermin: 12.01.-14.01.2014

1. Discuss the differences seperating the following pairs of terms:
   - Von-Neumann vs. Harvard-Architektur
   - Instructionword vs. Dataword
   - Hard wired vs. mikro programming
   - Horizontal vs. vertical microprogramming
2. Enumerate the five phases of the instruction execution and describe the used registers in each phase!
3. A new SUB-Instruction is to be added to the hypothetical processor. Think how a s SUB-Instruction may be designed based on the already existing ADD-Instruction. Specify it in *RTL*. Construct a corresponding micro programm.
   Th estructure of the *RTL* as well as the layout of the mikro programs can be found in the lecture slides.
4. A hypothetic large scale customer want to buy the hypothetic processor described in the lecture. There are two suppliers for the processor, *KombiProz* implemented the processor using hard wiring, where as *MikroHype* implemented it using micro programming. However, the company wants an additional instruction „$CLR\ A$“, which sets the A register to 0.
   Which of the two suppliers can deliver the modified processor faster? Which modifications are necessary?
5. This task aims to control a dish wasching machine using micro programming. The control uses five states:
   i) Flood – The valve V_1 is opened as long ($V_1 = 1$) the necessary water lever is not yet reached ($W_2 = 0$).
   ii) Heat upn – Until the water temperature is not yet reached T equals 0 the heater H is active ($H = 1$). After reaching the water temperature ($T = 0$) the heating stops ($H = 0$).
   iii) Clean – the pump is active ($P = 1$) and the valve V_3 is opened($V_3 = 1$). The water is transported through the machine cleaning the dishes. To ease the cleaning the detergent container is open ($B = 1$). This state lasts for 20 minutes.

iv) Empty – The water is removed from the machine by pumping all water through the opened ($V_2 = 1$). To maximise the effect the internal valve is closed ($V_3 = 0$). Since the detergent container cannot be closed again is stays opened. The emptying process ends when the water level drops below the minimum ($W_1 = 0$).

v) Dry – To dry the dishes the pump is deactivated an the heating is activated. Valve V_2 stays opened to remove remaining water. This state lasts for 10 minutes.

The control shall use mikro programming. Additionally a timer module is installed providing three inputs and one output . The inputs are $T_{Select}[0:1]$ to select a time and T_{Start} to start the timer. The output switches to one, after the configured time has passed. The configurable time intervals are 1 / 10 / 20 / 30 minutes, corresponding to the binary codes 00, 01, 10, 11.

Figure 1 depicts the physical setup of the dish washing machine. Figure 2 depicts the setup of the internal control system.

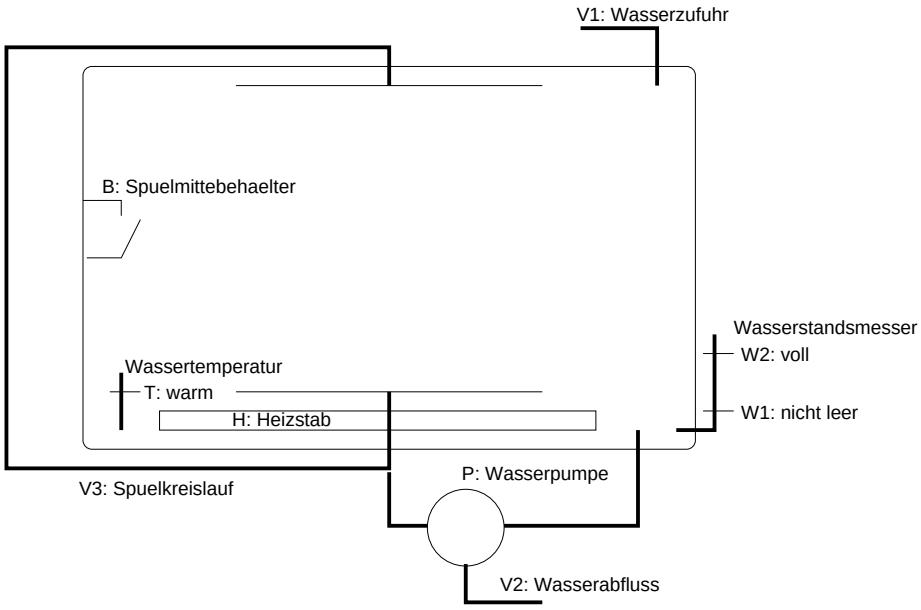

Abbildung 1: Schematic of the dish washing machine

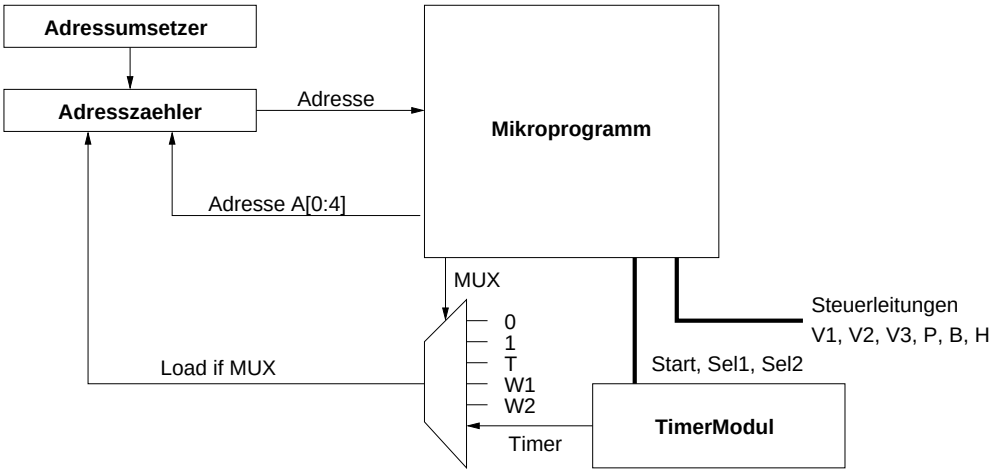

Abbildung 2: Schematic of the micro program based coontroller

a) Construct a table containing the states with their respective transition guards as well as the actuation!

b) Construct a micro program controlling one cleaning cycle of the machine. The format of each micro prgram word is as follows:

$A[0:4]$	$MUX[0:2]$	T_{Start}	$T_{Select}[0:1]$	V_1	V_2	V_3	P	B	H

$MUX[0:2]$ controls the multiplexer depicted in Figure 2.