LUNDS TEKNISKA HÖGSKOLA
Lunds universitet

Institutionen för datavetenskap
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Tentamen i kursen
E380: Konstruktion av inbyggda system
(Design of Embedded Systems)

2004-05-27, kl. 8-13

Sal:
MA10H-J

Hjälpmedel:
Inga

Resultat anslås:
Senast 2004-06-10

Poänggränser:
Max 40 p., för godkännande krävs ca 20 p.

Jourhavande lärare:
Kris Kuchcinski, tel. 22 23414

The answers to the questions can be written in Swedish or English.

Lycka till!

1 (4 p.)

Explain the term "design space exploration". What does it mean for embedded system design? What are the typical design parameters which are included in a design space exploration.

2 (4 p.)

Discuss a typical design methodology for embedded systems. When are different design activities, such as design specification, design partitioning, component allocation, and communication synthesis performed?

3 (4 p.)

Describe informally what are the execution rules for a data-flow network built of actors (that is how a model specified by a data-flow network is computed). Explain the notion of actors, tokens and firing rules.

4 (4 p.)

Figure 1 depicts a diagram for a Moore state machine. Write the VHDL code for the entity and architecture which implements this machine. Assume that at signal `reset = '0'` the machine should be initiated to state `S0`.

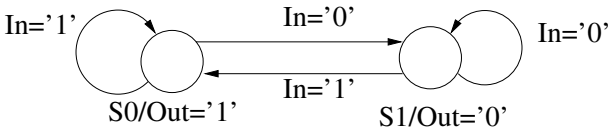

Figure 1: Specification of the state machine.

5 (4 p.)

Write the VHDL code for a process which implements a simple ALU unit. The ALU has a 2-bit control input which selects one of four operations, `+`, `-`, bitwise `and` operation and bitwise `or` operation between two 16-bit inputs. Assume combinatorial implementation of ALU.

6 (4 p.)

Figure 2 models the situation when two tasks want to get exclusive access to a shared resource, in our example a printer. Model, using Petri nets, the part of the figure which is depicted by a "cloud". This part, in response to request signals from tasks (request1 or request2) has to grant access to the printer to a single task and generate an acknowledge signal (acknowledge1 or acknowledge2). Each task releases the shared resource by generating release signals (release1 or release2).

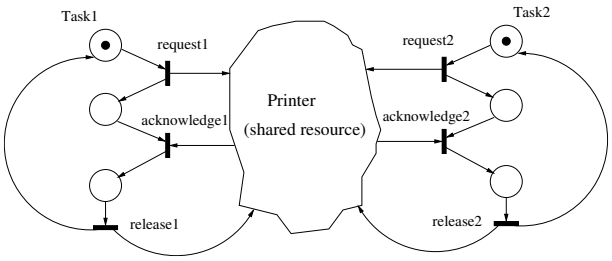

Figure 2: A model of a two tasks system with a shared resource.

7 (4 p.)

Using list scheduling, make a schedule for a data-flow graph depicted in Figure 3. Assume that you can use two adders and one multiplier. Adders have 1 clock cycle delay and multipliers 2 clock cycles delay. Explain what priorities are used in your list scheduling. What is the number of clock cycles for execution of this model?

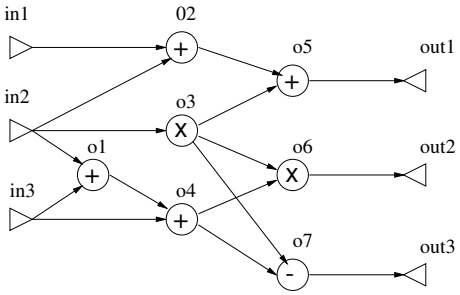

Figure 3: An example of data-flow graph

8 (4 p.)

Explain Rate Monotonic Scheduling (RMS). The presentations should include the following parts:

a) necessary assumptions about each task and its parameters,
b) the method to assign priorities, and
c) limitation of RMS analysis.

9 (4 p.)

What is the formula for power consumption in CMOS technology? Discuss how power consumption of a design can be minimized.

10 (4 p.)

Discuss briefly the main idea of SCAN path testability improvement technique. In the discussion include the following points:

a) the general idea of the SCAN path, and
b) why SCAN path improves test generation and testing time.