LUNDS TEKNISKA HÖGSKOLA
Lunds universitet

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

2003-08-25, kl. 14-19

Sal:
MA10E

Hjälpmedel:
Inga

Resultat anslås:
Senast 2003-09-08

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 (3 p.)

Give a short definition of embedded systems and discuss basic characteristics of such systems. Compare them with workstations and PC computer systems. Point out differences and similarities. Illustrate your discussion with examples of embedded systems.

2 (3 p.)

Hardware/Software co-design methodology becomes popular for embedded systems. Discuss basic ideas behind this methodology and compare it to a traditional design methodologies.

3 (4 p.)

Digital hardware is inherently parallel and this feature need to be modeled in specification and design languages. How does VHDL support parallelism for digital hardware specification. Discuss both specification method and underlying simulation semantics.

4 (4 p.)

Model the following conditional computation of the form
`if c then y = x + 1 else y = x - 1`
using Boolean data-flow (BDF) actors. You will probably need to use the typical data-flow actors such as "+" and "-" as well as specific BDF actors such as "select".

5 (4 p.)

Figure 1 models the situation when two tasks want to get an 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).

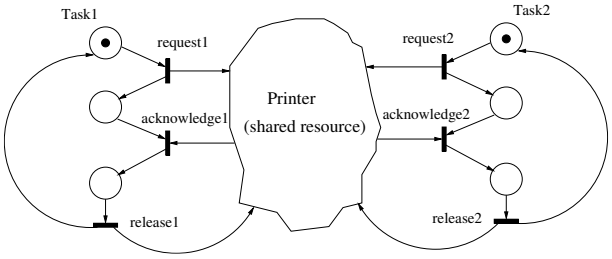

Figure 1: A model of a two tasks system with a shared resource.

6 (4 p.)

System partitioning can be done using partitioning or clustering algorithms. These algorithms use either *objective* or *closeness* functions to make appropriate decisions decisions. Explain how are *objective* or *closeness* functions defined? How partitioning or clustering objectives, such as minimum communication between partitions and similar size of partitions, are reflected. Give examples.

7 (6 p.)

Using forced-directed scheduling, make a schedule for a data-flow graph depicted in Figure 2. Assume that adders have 1 clock cycle delay and multipliers 2 clock cycles delay. What is the minimum number of adders and multipliers for a single execution of the graph in 5 clock cycles?

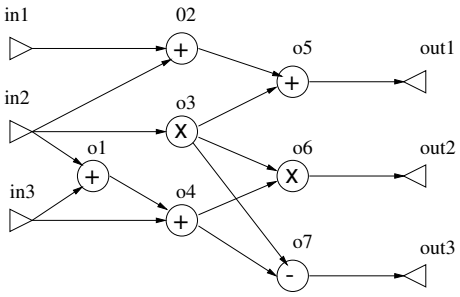

Figure 2: An example of data-flow graph

8 (4 p.)

Describe briefly Earliest Deadline First (EDF) dynamic priority scheduling.

9 (4 p.)

What are the main sources of power consumption in CMOS technology (use an equation for power consumption to support your discussion)? How can power consumption be minimized when designing hardware?

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.