



Försättsblad till skriftlig tentamen vid Linköpings universitet

(fylls i av ansvarig)

Datum för tentamen	2013-03-26
Sal	TER 2
Tid	14:00 - 18:00
Kurskod	TDTS08
Provkod	TEN1
Kursnamn/benämning	Datorarkitektur Skriftlig tentamen
Institution	IDA
Antal uppgifter som ingår i tentamen	13
Antal sidor på tentamen (inkl. försättsbladet)	5
Jour/Kursansvarig	Zebo Peng
Telefon under skrivtid	0702582067
Besöker salen ca kl.	15:45
Kursadministratör (namn + tfnr + mailadress)	Liselotte Lundberg, 013-281278, <liselotte.lundberg@liu.se>
Tillåtna hjälpmedel	Engelsk ordbok
Övrigt (exempel när resultat kan ses på webben, betygsgränser, visning, övriga salar tentan går i m.m.)	
Vilken typ av papper ska användas, rutigt eller linjerat	rutigt
Antal exemplar i påsen	25

TEKNISKA HÖGSKOLAN I LINKÖPING
Institutionen för datavetenskap (IDA)
Zebo Peng

Tentamen i kursen

TDTS08 Datorarkitektur

(Examination on TDTS 08 Advanced Computer Architecture)

2013-03-26, kl.14-18

Hjälpmedel:

Engelsk ordbok.

Supporting material:

English dictionary.

Poänggränser:

Maximal poäng är 40.

För godkänt krävs 21 poäng.

Points:

Maximum points: 40.

You need 21 points to pass the exam.

Jourhavande lärare (Teacher on duty):

Zebo Peng, tel. 070 258 2067, 013-28 2067

Note: You can give the answers in English or Swedish.

1. a) There are several write policies that are used to keep the cache contents and the contents of the main memory consistent. Describe briefly each of these policies and discuss the advantages and disadvantages of each of them, respectively.
b) Describe the additional problems we have when applying these policies in a multiprocessor system.

(4p)

2. The following sequence of virtual page numbers is encountered in the course of execution on a computer with virtual memory:

7 5 4 5 4 2 3 6 4 7 1 2 1 7

Assume that the least-recently used (LRU) page replacement policy is used. Assume also that the main memory has four page frames, and is initially empty. How many page misses will be during this execution? Which are the virtual pages in the main memory when this execution finishes?

(3p)

3. What does it mean by delayed branch? Use an example to illustrate the concept. What can this technique be used for?

(2p)

4. a) What does it mean by dynamic branch prediction?
b) Describe one way to implement the dynamic branch prediction approach.
c) What are the advantages and disadvantages of dynamic branch prediction, as compared to static branch prediction?

(3p)

5. The design of RISC architectures is based on certain characteristics of program execution.

- a) What are the characteristics concerning procedure calls and returns?
- b) What is the mechanism used in a RISC architecture to make procedure calls and returns efficient? How does this mechanism work?

(3p)

Note: You can give the answers in English or Swedish.

6. a) In a CICS architecture, a micro-memory is usually used to store the microprograms. Should the micro-memory be considered as a part of the memory hierarchy in a computer architecture. Why?
b) What are the main differences between a micro-memory and a main memory.
(3p)
7. a) Draw a picture to show a typical VLIW architecture.
b) A VLIW architecture is said to support explicit parallel instruction execution. Define the concept of explicit parallelism. What are the advantages of exploiting explicit parallelism?
c) What is the main problem of a VLIW computer? How is this problem addressed by the IA-64 architecture?
(4p)
8. a) Define the concept of loop unrolling. Why is loop unrolling very useful in the context of a VLIW processor?
b) If a loop is unrolled completely (i.e., there is no need for loop control any longer), what will happen? Discuss all the negative side effects of unrolling a loop completely?
(3p)
9. a) What is a vector processor? Draw the block diagram of a typical vector processor architecture.
b) What is the role of the mask register in a vector unit? Give an example to illustrate the use of the mask register.
(3p)
10. a) What is a directory protocol? What is it used for? Give an example of an architecture where a directory protocol is usually used.
b) What are the advantages and disadvantages of a directory protocol, as compared with a snoopy protocol?
(3p)

Note: You can give the answers in English or Swedish.

11. a) Describe the different multithreading approaches and discuss how they are applied in the context of superscalar architectures. What are the advantages and disadvantages of these different approaches, respectively?
b) Why does multithreading improve system performance even in the case when there is only a single scalar processor in your computer?

(3p)

12. a) One argument for using a graphics processing unit (GPU) is that it is power efficient. Describe all features of a GPU architecture that contribute to the reduction of power consumption.
b) Can we use GPUs for non-graphics computation? Support your answer with some good arguments.

(3p)

13. We have discussed several techniques to reduce power consumption of processor cores. One of them is called pipeline gating.
a) What does it mean by pipeline gating?
b) Describe one way to implement the pipeline gating technique.

(3p)