Architetture degli Elaboratori II
I Test - 21/5/2001

Name :

Write the solutions on these sheets, following each question. Each exercise reports its value in marks: total marks 33/30.

QUESTIONS

1. (marks: 6)
   In the method area of the main memory you find the following sequence of IJVM instructions that must be executed from the cell pointed by the PC. What does the top cell of the stack contain at the end of the execution ?

	...
	01100100
	00100011
	00010000
	11001010
PC ⇒	00010000
	...

2. (marks: 5)
   Describe in details the memory model of the IJVM machine and how the CPU exchange information with the main memory (support your description with graphical sketches).

3. (marks: 6)
   The complete JVM language contains instructions to load on the stack the local variables displaced by 1, 2 or 3 positions with respect to LV. Each one of these instructions has its own opcode and no operand.
   (a) Explain what could be the usefulness of these instructions.
   (b) Consider, as an example, the instruction ILOAD_2 that pushes on the top of the stack the local variables displaced by 2 positions with respect to LV.
   Write the micro-interpreter MIC-1 for the instruction ILOAD_2.
   (c) For each micro-instruction of the preceding point report its binary coding.

4. (marks: 6)
   In the main memory you find 3 integer variables stored in subsequent cells starting from the cell displaced by 5 positions with respect to LV. Answer the following questions.

(a) Write a IJVM program that computes the sum of the variables only if with positive value (> 0) and writes the result in the cell displaced by 4 positions with respect to LV.

(b) Write for each IJVM instruction its binary (or hexadecimal) coding.

(c) In the hypothesis that the MIC-1 machine, on which the above program is executed, has a clock at 250 MHz, find how much time is needed to execute your program.

5. (marks: 5)
Describe all the possible ways in which a micro-instruction can indicate which is the micro-instruction to be executed in the next cycle.

6. (marks: 5)
If, in the IJVM language, the prefix WIDE could be applicable to the instruction BIPUSH to form the instruction WIDE-BIPUSH:

(a) which could be the meaning of the instruction WIDE-BIPUSH;

(b) write the sequence of micro-instructions MIC-1 to interpret the new instruction WIDE-BIPUSH.

Architetture degli Elaboratori II
I Test - 21/5/2002

First Name, Name :

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1. (punti: 5)
   Explain how the CPU communicates with the main memory in the MIC-1 architecture. Indicate which CPU registers are involved, which fields of the MIR register and how, and finally indicate the timing of the various operations with respect to the CPU clock.

2. (punti: 7)
   You must transfer the two most significant bytes of a local variable A into the two less significant bytes of a local variable Y.

   (a) Explain in plain words how you intend to tackle the problem.

   (b) Implement a method in IJVM symbolic language.

   (c) Translate each symbolic IJVM instruction in binary (or hexadecimal) code.

   (d) Assuming that the MIC-1 machine, on which the above program is executed, is equipped with a 250 MHz clock, find how much time is needed to execute the program at point *b)*.

3. (punti: 6)
   Translate the following MIC-1 instructions (in hexadecimal code) in MAL, and then answer the following questions:

   (a) Starting from the μ-instruction with address $0x010$, indicate the sequence of μ-instructions that are executed if $TOS = 0x00000000$?

   (b) Starting from the μ-instruction with address $0x010$, indicate the sequence of μ-instructions that are executed if $TOS = 0xFFFFFFFF$?

Control store Address	Hex Microinstruction
0x010	090354007
0x011	09A140008
0x012	089140008
0x013	HALT
0x111	098140488
0x112	NOP
0x113	NOP

4. (punti: 6)
   It is requested to program in the MAL language the following operation.
   The SP register contains an address pointing to a word in the main memory. You must compute the EXOR between the word addressed by SP and the following word in the main memory. The result must be stored in the still subsequent word (you can utilize any CPU register to memorize intermediate results).

5. (punti: 4)
   Describe in details (possibly with graphical aids) all the possible functions of the stack in the MIC-1 architecture.

6. (punti: 5)
   You want to extend the capabilities of the IJVM conditional branches, by adding a new instruction indicated as ifgt <offset> where offset is a 16-bit signed constant. The instruction takes the branch if the word on the top of the stack is (strictly) greater than 0. Without modifying the MIC-1 architecture:

   (a) Illustrate the operation of this new instruction.

   (b) Write the μ-interpreter for this new insrtruction.