University of Swaziland

Faculty of Science
Department of Computer Science

Final Examination, 2006

Title of Paper: Computer Organisation I

Course Number: CS241

Time Allowed: Three (3) hours

Instruction: Answer all questions. Questions carry equal marks.

You are reminded that in assessing your work, account will be taken of the accuracy of the material, of the language used and the general quality of expression, together with the layout and presentation of your answer. Remember full answers will usually *define, explain and exemplify*.

Special Requirement:

Calculators are prohibited.

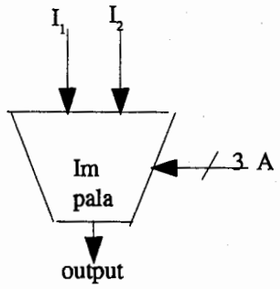
Table of IJVM instructions (appended)

This examination paper should not be opened until permission has been granted by the invigilator.

Question 1. [20]

The following extract, which follows the conventions introduced in the course, is from a provisional data sheet of an experimental ALU.

Data sheet for the Impala ALU



A_1	A_2	A_3	I_1	I_2	output
0	0	0			+
0	0	1			-
0	1	0			oparity
0	1	1			XOR
1	0	0			AND
1	0	1			IOR
1	1	0			NOT
1	1	1			eparity

The functions *eparity* and *oparity* produce 1 if the input has even or odd parity respectively.

What function of I_1 and I_2 appears at the output for the following settings of A and I?

	A_1	A_2	A_3	I_1	I_2
a)	1	0	1	1	0
b)	1	1	1	1	0
c)	0	0	0	0	1
d)	0	0	0	1	1
e)	0	1	0	1	1
f)	1	0	0	1	0
g)	0	1	1	1	0

Question 2. [20]

(a) Express the 16-bit number $FF23_{16}$ in decimal when the computer uses:

(i) 2s complement arithmetic

(ii) 1s complement arithmetic

(b) Convert 3747_{10} to hexadecimal

(c) Write the following Pascal statement:

m := m + n – 1;

in:

i) Java

ii) Java assembly language

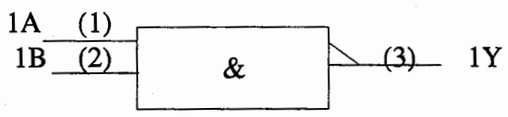
iii) Java JVM machine code.

Question 3. [20]
What are the fundamental security designs of the JVM paradigm?

Question 4. [20]
(a) Explain fully, with diagrams, each of the following terms:

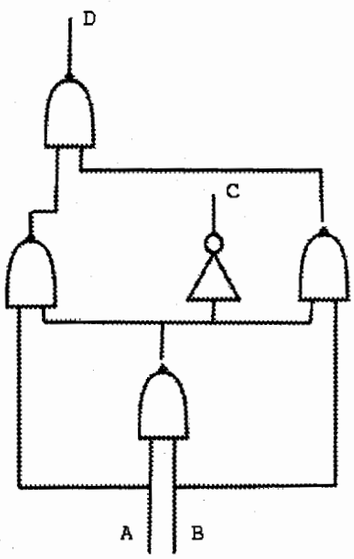
i) this computer is big endian
ii) pin 5 is asserted high
iii) the clock (in digital circuits)

(b) Part of the logic symbol for a well-known chip is:



Draw the associated part of the package pinout.

Question 5. [20]
What does this circuit, of NAND and NOR gates, do?



Question 6. [20]
The MIC1 is a simulator.

a) What, in general terms, is a simulator?
b) How does it differ from an emulator?
c) What, exactly, does the MIC1 simulate?

Table of IJVM instructions

hex	mnemonic	meaning
10	BIPUSH byte	push byte onto stack
59	DUP	copy top word on stack and push onto stack
A7	GOTO offset	unconditional branch
60	IADD	pop two words from stack; push their sum
7E	IAND	pop two words from stack; push Boolean AND
99	IFEQ offset	pop word from stack; branch if it is zero
9B	IFLT offset	pop word from stack; branch if it is less than zero
9F	IF_ICMPEQ offset	pop two words from stack; branch if equal
84	IINC varnum const	add a constant to a local variable
15	ILOAD varnum	push local variable onto stack
B6	INVOKEVIRTUAL disp	invoke a method
80	IOR	pop two words from stack; push Boolean OR
AC	IRETURN	return from method with integer value
36	ISTORE varnum	pop word from stack; store in local variable
64	ISUB	pop two words from stack; push their difference
13	LDC_W index	push constant from constant pool onto stack
00	NOP	do nothing
57	POP	delete word on top of stack
5F	SWAP	swap the top two words on the stack
C4	WIDE	prefix instruction; next instruction has 16-bit index

End of examination paper