University of Cape Town
Department of Computer Science

Computer Science CSC116S

Test 3 - 5 October 2005

- Answer all questions.
- All questions that refer to elements of programming make reference to the Java programming language as studied in class.
- Good luck !

Marks: 40

Time: 40 minutes

- Approximate marks per question are shown in brackets
- The use of calculators is permitted

NAME: Surname Initials

STUDENT NO: **COURSE CODE:** CSC

This paper consists of 6 questions and 6 pages (including this cover page).

Mark Allocation							
Quest	Marks	Internal	External	Quest	Marks	Internal	External
1	[15]			4	[3]		
2	[5]			5	[2]		
3	[1]			6	[14]		
	Total				**Total**		
					Grand Total		
					Final Mark		
Internal Examiner:				**External Examiner:**			

Section 1. Number Systems, Boolean Algebra and Logic

Question 1. [15 marks]

Show all calculations for the following questions.

a) Convert 117.375_{10} to radix 2.

[2]

b) Convert 345_8 to hexadecimal.

[2]

c) Use 4-bit 2's complement binary addition to calculate $6_{10} - 2_{10}$.

[3]

d) What is the value of `0 10000010 11000000000000000000000` in IEEE 754 format?

[3]

e) In IEEE 754 format, what is the difference between exponent overflow and exponent underflow? What values can be used as approximations in each case?

[3]

f) Using an example, show how the alignment of two floating point numbers, for addition, can result in a loss of precision.

[2]

Question 2. **[5 marks]**

a) If $A = 0$, $B = 1$ and $C = 0$, what is the value of $F = A + (\overline{A} \cdot B) + C$?

[1]

b) Using a truth table, prove De Morgan's Law : $\overline{A} \cdot \overline{B} = \overline{A + B}$

[4]

Section 2. MIPS

Refer the the attached MIPS instruction set specification when answering these questions.

Question 3. [1 marks]

What is the size, in bits, of a register in the MIPS machine?

[1]

Question 4. [3 marks]

Explain the purpose for which the following registers in the MIPS machine are used

a) Instruction Register

[1]

b) Program Counter

[1]

c) Register $0

[1]

Question 5. [2 marks]

Give the 4 steps that the Control Unit of a computer does.

[2]

Question 6. [14 marks]

Write a MIPS assembler program that does the same as the following Java program. Note that the program may not make a lot of sense, but that it is logically correct.

```
Public static void main(String args[ ]) {
   int a=10, b=15, c=20;
   int ans;
   if (a>b) { ans = a + b + c; }
   else {
      ans = b  a;
      System.out.println(ans);
   }
}
```

[14]