

Massey University

ALBANY CAMPUS

EXAMINATION FOR 59.102 COMPUTER SCIENCE FUNDAMENTALS
Semester Two - 1999

Time Allowed: THREE (3) Hours

INSTRUCTIONS

Attempt **ALL FIVE (5)** questions.

This final examination contributes 70% to the final assessment.
Calculators are permitted.

Turn over to pg. 2...

1. (a) Convert the following unsigned binary numbers to decimal numbers.
- (i) 11001100
 - (ii) 01010101
- [2 marks]*
- (b) Convert the following signed 8 bit twos complement binary numbers to decimal numbers.
- (i) 11110110
 - (ii) 01111100
- [2 marks]*
- (c) Convert the following unsigned hexadecimal numbers to decimal numbers.
- (i) 423
 - (ii) 10e
- [2 marks]*
- (d) Briefly explain the difference between a carry and a borrow.
- [2 marks]*
- (e) Convert the following decimal numbers to fixed point binary.
- (i) 12.75
 - (ii) 3.625
- [2 marks]*
- (f) Describe a format suitable for storing floating point numbers using 16 bits.
- [2 marks]*
- (g) Write a C function that converts a character representing a single hexadecimal digit to an integer.
- [2 marks]*

Turn over to pg. 3...

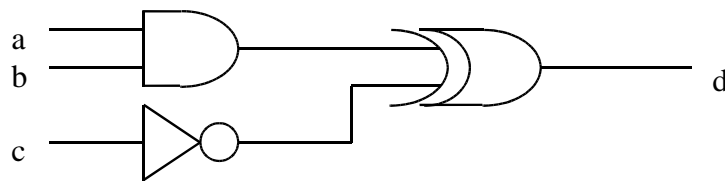
2. (a) What is the output of the following section of C program?

```
a = 0xf0;
b = a & 0x34;
b = b ^ a;
b = b | 0x82;
printf( "%x\n" ,b );
```

Show all your working.

[4 marks]

- (b) Draw a truth table for the following logic diagram.



[3 marks]

- (c) What is an ALU?

[2 marks]

- (d) What does the following assembly language program do? Assume the first operand is the destination and addresses are enclosed in [].

```
XOR A,A
ADD A,[100]
ADD A,A
ADD [100],A
```

[3 marks]

- (e) Briefly describe the concept of Pipelining.

[2 marks]

Turn over to pg. 4...

3. (a) A circular queue is implemented using an array and the following global declarations.

```
int queue[100];  
  
int head;  
int tail;
```

- (i) Write a C function to put a number at the tail of the queue. *[3 marks]*
- (ii) Write a C function to remove a number from the head of the queue. *[3 marks]*
- (b) The following names are inserted into an ordered tree. The tree is ordered lexicographically (in dictionary order).
lemon,apple,orange,pineapple,mango,rambutan,avocado
Draw the resulting tree. *[3 marks]*
- (c) An ordered list contains the following words.
(asafoetida, chilli, coriander, cumin, fenugreek, nutmeg, paprika, turmeric)
Which words will be examined when using a binary search to lookup the word fenugreek? *[2 marks]*
- (d) What is an Abstract Data Type? How does using ADTs improve the readability of programs? *[3 marks]*

Turn over to pg. 5...

4. (a) What output does the following program produce:

```
#include <stdio.h>

int ting(int x,int y) {
    if(y==0)
        return x;
    else
        return ting(y, x % y);
}

void main() {
    printf("%d\n",ting(20,8));
}
```

Show all your working.

[3 marks]

- (b) A bubble sort is used to sort the following array,

(8,78,1,9,10)

Show all the steps involved in this sort.

[2 marks]

- (c) The following is a BNF grammar that describes a simple sentence.

```
<object> := cat|dog
<verb> := likes|eats
<sentence> := <object> <verb> <object>
```

Give all valid sentences.

[3 marks]

- (d) A program must be written to check for similarity between assignments. A function called simcheck has already been written that returns 1 if the assignments for two students are similar. The program uses the following declarations.

```
int simcheck(int id1,int id2); // return 1 if assignments
                               // for id1 and id2 are similar

int id[300]; // array of student ids
int no_of_students; // number of students
```

Write a function to print a list of all pairs of similar assignments, each pair should only appear in the list once.

[4 marks]

- (e) What is the complexity (in big O notation) of your algorithm for part (d)?

[2 marks]

Turn over to pg. 6...

5. Briefly define the following terms:

- (i) Source Code
- (ii) Memory Management
- (iii) Assembler
- (iv) Datapath
- (v) Syntax Error
- (vi) Scheduling
- (vii) The Imperative Paradigm

[14 marks]