PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Department of Computer Engineering

Final Examination: Semester 1 **Academic Year**: 2007-2008

Date: Wednesday, 3rd October, 2007 **Time**: 13:30 – 16:30 (**3 hours**)

Subject Number: 240-304 **Room**: R200

Subject Title: Mathematics for Computer Engineering

Lecturer: Aj. Andrew Davison

Exam Duration: 3 hours

This paper has 4 pages.

Authorized Materials:

- Writing instruments (e.g. pens, pencils).
- Books (e.g. dictionaries) and calculators are **not** permitted.

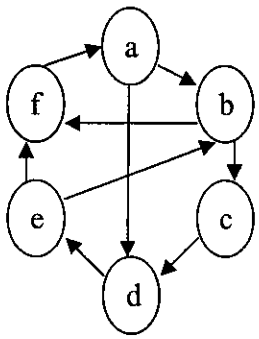
Instructions to Students:

- *Answer questions in English.* Perfect English is **not** required.
- Attempt all questions.
- Write your answers in an answer book.
- Start your answer to each question on a new page
- Clearly number your answers.
- Any unreadable parts will be considered wrong.
- When writing programs, use good layout, and short comments; marks will not be deducted for minor syntax errors.
- The marks for each part of a question are given in brackets (...).

Question 1

(30 marks; 30 minutes)

For the following graph:



a) Draw an adjacency list for the graph. (10)

b) Draw an adjacency matrix for the graph. (5)

c) Give the ANSI C data types for the adjacency list **and** the adjacency matrix. (10)

d) If the adjacency matrix is called A, what does an entry in row i and column j mean in A^3 ? (5)

Question 2

(30 marks; 30 minutes)

For the table below:

a) Draw a graph. The cities should be nodes, the distances edges. (10)

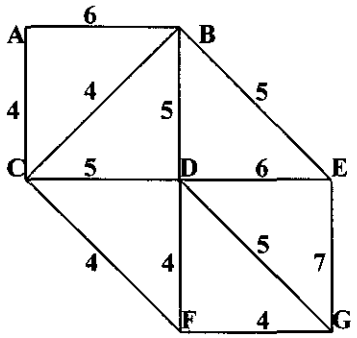
b) Using Dijkstra's algorithm, find the shortest distances from Detroit to **all** the other cities. If a city cannot be reached from Detroit, then its minimum distance should be "infinity". Show **all** your working. (20)

City 1	City 2	Distance
Marquette	Sault Ste. Marie	153
Saginaw	Flint	31
Grand Rapids	Lansing	60
Detroit	Lansing	78
Escanba	Sault Ste. Marie	175
Ann Arbor	Detroit	28
Ann Arbor	Battle Creek	89
Battle Creek	Kalamazoo	21
Menominee	Escanba	56
Kalamazoo	Grand Rapids	45
Escanba	Marquette	78
Battle Creek	Lansing	40
Flint	Detroit	58

Question 3

(30 marks; 30 minutes)

Consider the following graph:



a) Use Prim's algorithm to find the minimum spanning tree. Show your working. (15)

b) Use Kruskal's algorithm to find the minimum spanning tree. Show your working. (15)

Question 4

(30 marks; 30 minutes)

Explain in words the following concepts:

a) game tree; (5)

b) evaluation function; (5)

c) the minimax algorithm; (10)

d) alpha-beta pruning. (10)

Each idea should be illustrated with a **brief** example game, such as tic-tac-toe, or another simple game that you know.

Question 5

(30 marks; 30 minutes)

Consider the regular expression:

$$(0 \mid 1 \mid 1^*)^*$$

a) Draw an automaton with ε-transitions for the regular expression. (15)

b) Draw an equivalent automaton to the one in (a) *without* using ε-transitions. (10)

c) Is the automaton of (b) deterministic? If it is not deterministic, draw an equivalent automaton which is deterministic. (5)

Question 6 on next page.

Question 6

(30 marks; 30 minutes)

Consider the following grammar for numbers:

Number → Digit Number | ε
Digit → 0 | 1 | 2 | ... | 9

a) Translate the grammar into syntax graphs. (5)

b) Translate the syntax graphs into a parser. The parser should print "yes" if the input string matches the grammar; "no" otherwise. The parser should **not** build a parse tree. (15)

c) What problems will occur with translating the following grammar rule into a parser function: (5)

Number1 → Number1 Digit | Digit

d) Explain how to translate the grammar rule in (c) into a more suitable form for parsing. Do **not** write syntax graphs or a parser, only the modified grammar. (5)

--- End of Examination ---