PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Department of Computer Engineering

Final Examination: Semester 1 **Academic Year**: 2004-2005

Date: Saturday, 2nd October, 2004 **Time**: 13:30 – 16:30 **(3 hours)**

Subject Number: 240-304 **Rooms**: A400 **and** A401

Subject Title: Mathematics for Computer Engineering

Lecturer: Aj. Andrew Davison

Exam Duration: 3 hours

This paper has 3 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)

The *Heap* game for two players. The start position consists of one heap of seven stones. A turn consists of taking 1, 2, or 4 stones from the heap. The player who takes the last stones or stone from the heap (leaving it empty) is the **winner**.

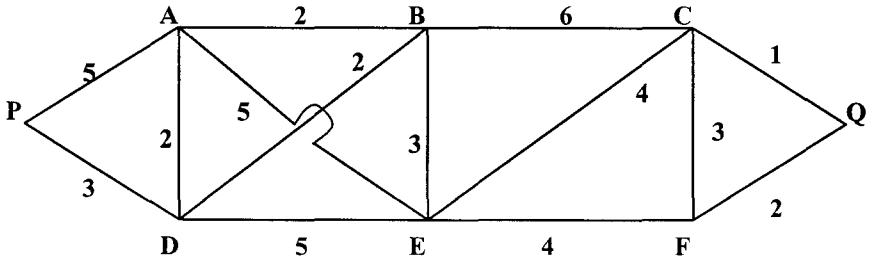
a) Draw the complete game tree for the *Heap* game. Assign values to all the vertices of the game tree. (20)

b) Can the first player always win? Explain your answer in words. (5)

c) Give a winning sequence of turns for the winning player. Explain in words why it is a winning sequence. (5)

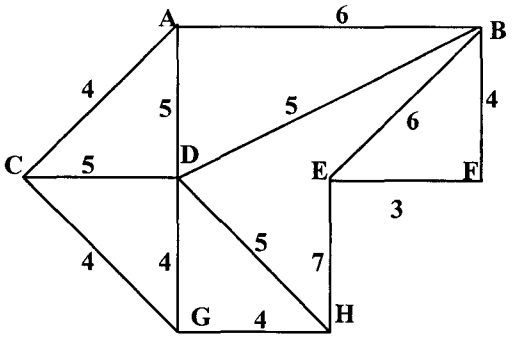
Question 2 (25 marks; 25 minutes)

Find the path with minimum length from node P to node Q by using Dijsktra's algorithm. Show all your working. Also, write down the minimum path, and its length.



Question 3 (30 marks; 30 minutes)

Consider the following graph:



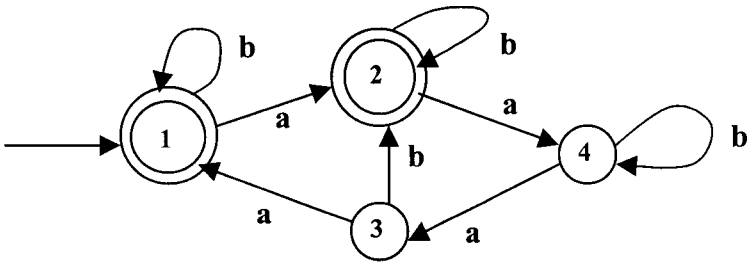
a) Use **Prim's** algorithm to find the minimum spanning tree. Show all your working, and explain it in words. (15)

b) Use **Kruskal's** algorithm to find the minimum spanning tree. Show all your working, and explain it in words. (15)

Question 4

(25 marks; 25 minutes)

Consider the following automaton:



a) Does the automaton accept the string "bbaab"? Show your working. (5)

b) Does the automaton accept the string "baaaa"? Show your working. (3)

c) Does the automaton accept the empty string ""? Show your working. (2)

d) Translate the automaton into C code. (15)

Question 5

(40 marks; 40 minutes)

Consider the grammar:

S → c B A A → b A A → a A → d B → A a c

The nonterminals are {S,A,B}, the terminals are {a,b,c,d}, and the start symbol is S.

a) Draw a parse tree for the string "cdacbd". (5)

b) Translate the grammar into syntax graphs. Show all your working. (10)

c) 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. (25)

Question 6

(30 marks; 30 minutes)

Two groups of people live on the Keikei Island – knights and knaves. Knights always tell the truth, the knaves always lie.

John and Bill live on the Keikei Island. John says: "We are both knaves".

What group does John belong to? What group does Bill belong to?

Use **propositional logic** to represent the problem as a *single* logical statement. Then simplify the statement to obtain the answer. Explain your answer in words.

--- End of Examination ---