Faculty of Science
Final Examination

Computer Science COMP-102A
Computers and Computing

Examiner: Prof. Claude Crépeau  Date: Dec. 5, 2013
Associate Examiner: Prof. Joëlle Pineau  Time: 18:00 – 21:00

INSTRUCTIONS:
This examination is worth 40% of your final grade.
The total of all questions is 105 points.
Each question is assigned a value found in brackets next to it.
OPEN BOOKS / OPEN NOTES
Faculty standard calculator permitted only.
This examination consists of 4 pages including title page.
This examination consists of 12 questions.

Suggestion: read all the questions and their values before you start.
1) Explain why the 3 following tic-tac-toe configurations are qualified as terminal:

(A) X | O | X       O | X | O       O | X | O
    ————       ————       ————
    | O | X        O | X | X       X | X |
    ————       ————       ————
    | O |            X | O | X       O | X | X

(B) O | X | X        X | X | O       O | X | O
    ————       ————       ————
    | O | X        O | X | X       X | X |
    ————       ————       ————
    | O |            X | O | X       O | X | X

(C) O | X | X        X | X | O       O | X | O
    ————       ————       ————
    | O | X        O | X | X       X | X |
    ————       ————       ————
    | O |            X | O | X       O | X | X

For each of the 3 configurations above say whether their utilities are -1, 0, 1 and explain why.

2) Explain whether the map of the USA is 1-colorable? 2-colorable? bonus 3-colorable? 4-colorable?

3) Remember this quote from Seymour Cray used by prof. Kry:

“If you were plowing a field, which would you rather use: Two strong oxen or 1024 chickens?”

Explain what this quote has to do with computer science!
4) Explain the 3 different types of **mutations** and provide an example for each.

5) Explain what are **effectors** and **actuators** and provide an example of each.

6) Explain why the **citation network** is an example of a "conceptual network".

7) Consider the following graph and provide its adjacency matrix.

8) Rewrite the following function using **recursion** instead of **iteration** :

   ```javascript
   function exp(n){
       m=1;
       for (var i=1; i<=n; i++){ m=2*m; }
       return( m )
   }
   ```

9) Explain why current identification systems based on entering a PIN code to authorize monetary operations is not very secure…
10) Consider the following circuit:

If the input to the top row is 1000 and the input to the second row is 1101, then what is the output at the bottom of the circuit?

11) Explain the four generations of computer, say when they happened in time and explicit their characteristics.

12) Provide a set of tiles that constitute a YES instance of the Post correspondence problem, and provide a set of tiles that constitute a NO instance of the Post correspondence problem. Justify your answers.