IFT 2125 – Introduction à l'algorithmique – TP5

21 mars 2017, à remettre **au début** de la démo du 31 mars

Attention : N'hésitez pas à vous aider d'un ordinateur pour faire les deux premiers problèmes, qui pourraient être pénibles à la main ! Par contre, je vous conseille vivement de faire le troisième problème à la main afin de vous familiariser avec la notion de graphe de jeu.

Question 1. Faites l'exercice 9.2 du livre *(attention, j'ai ajouté une phrase à la fin !)* :

Can a winning position in the game described in Section 9.1 have more than one losing position among its successors? In other words, are there positions in which several different winning moves are available? Can this happen in the case of a winning initial position $\langle n, n-1\rangle$? *Le cas échéant, donnez le plus petit* n *pour lequel cela se produit.*

Question 2. Faites l'exercice 9.3 du livre :

Suppose we change the rules of the game of Section 9.1 so that the player who is forced to take the last match *loses*. This is the *misère* version of the game. Suppose also that the first player must take at least one match and that he must leave at least two. Among the initial positions with three to eight matches, which are now winning positions for the first player?

Question 3. Faites l'exercice 9.7 du livre :

Consider the following game. Initially a heap of n matches is placed on the table between two players. Each player in turn may either (a) split any heap on the table into two unequal heaps, or (b) remove one or two matches from any heap on the table. He may not do both. He may only split one heap, and if he chooses to remove two matches, they must both come from the same heap. The player who removes the last match wins.

For example, suppose that during play we arrive at the position $(5, 4)$; that is, there are two heaps on the table, one of 5 matches, the other of 4. The player whose turn it is may move to $(4, 3, 2)$ or $(4, 4, 1)$ by splitting the heap of 5, to $(5, 3, 1)$ by splitting the heap of 4 (but not to $(5, 2, 2)$, since the new heaps must be unequal), or to $(4, 4)$, $(4, 3)$, $(5, 3)$ or $(5, 2)$ by taking one or two matches from either of the heaps.

Sketch the graph of the game for $n = 5$. If both play correctly, does the first or the second player win?

Question 4. Faites l'exercice 9.25 du livre :

Illustrate the progress of the depth-first search algorithm on the graph of Figure 9.5 if the starting point is node 1 and the neighbours of a given node are examined in *decreasing* numerical order.

Question 5. Faites l'exercice 9.34 du livre :

List the first 15 nodes visited by a breadth-first search of the graph of Figure 9.11 starting at node 1 and visiting neighbours in the order "first division by 3, then multiplication by 2".