

Due 9/8/11

1. Find a *simple* function $g(n)$ so that $(6n^2 - n \log n)/(8n - 3\sqrt{n}) = \theta(g(n))$. Carefully justify your answer, using only basic algebra facts and showing all steps. Clearly identify your constants C and n_0 . [You may assume $\log n \leq n$ for $n \geq 1$.]

2. Suppose we have three jugs with capacities of 9, 8 and 2 pints. The 9 pint jug is empty and the other two are full of water. The goal is to be able to divide this total of 10 pints of water into two equal portions. We are only able to transfer water between jugs; we cannot empty a jug or add more water.

(a) Display a breadth-first search (directed) *tree*, starting at $(0,8,2)$, showing all states that are accessible. Do not list states more than once.

(b) What is the minimum number of pourings needed to divide the 10 pints into two equal portions.

(c) Show a sequence of states that correspond to the minimum number of pourings.

3. In the chessboard below, a knight piece is to be moved from square A to square B using the minimum number of (valid) moves. The knight can jump over, but cannot land, on any shaded square. A knight moves in an L-shaped manner: two squares in one direction and one in the other.

(a) Draw an appropriate (undirected) graph and identify a solution having the minimum number of moves. HINT: Label each node as (i, j) ; e.g. $A = (4,1)$ and $B = (2,1)$.

(b) How many different solutions are there that achieve the minimum number of moves?

B				
A				