* Deep Blue I lost in 1996; Deep Blue II won in 1997
* 1988 Deep Thought: first AI to beat a Grandmaster in a tournament
  + Deep Thought 2 had an improved evaluation function, parallel search software, extended book of moves, and more multiprocessing support.
* Contributors to the win:
  + Single chip search tree engine
  + Multi levels of parallel computing
  + Search extensions
  + Complex evalution function
  + Grandmaster game database
* Deep blue overview
  + 3 layers – master + workers
    - Master searches top levels then distributes leafs to workers, which then search deeper
  + Average search speed of 126 million positions per second
  + Uses quiescence search, iterative deepening, transposition tables, and NegaScout
  + Its search is non-uniform – so some nodes are searched deeper than others
  + Didn’t implement pruning in hardware search
  + Averaged 12.2 levels deep after 3 min search
  + Hybrid of hardware and software search. Hardware search’s form is fixed, so new search behaviours can’t be introduced
  + Risk of horizon effects because the two searches are very different
  + Over 500 processors for tree search
  + Has 2 evaluation functions:
    - Fast heuristic scores the board state using the pieces on the board and their positions
    - Slow heuristic scores the board by scanning column-by-column for different chess concepts like king safety and square control
  + Search uses null-window alpha-beta search
    - Null-window simplifies hardware design but sometimes multiple searches are needed for an exact score
    - There’s also no transposition table in the hardware search, which significantly improves search efficiency
    - But at least the upper levels are done by software, which use a transposition table
    - Search uses a repetition detector, which tracks the number of pieces displaced in the last 32 positions. When that value is 0, a move has been repeated
  + Software search used based on a depth-limited minimax search with alpha-beta pruning.
  + was called ‘dual credit with delayed extensions’
    - No progress pruning assumes that ‘if a move is good for a given side, it’s best to player it earlier rather than later’. It checks if a current position could have been reached by playing an alternate move earlier in the game, which causes the search to be terminated
    - No progress pruning can have an effect in some situations
  + Hardware search is fast but simple so it usually only goes 4 or 5 layers deep
  + Workers already have their next job ready to execute before they complete their current job to improve parallelism and avoid overloading the master
  + Deep Blue used an opening book made by grandmasters which comprised of 4000 positions, which were chosen to ‘emphasize positions that Deep Blue played well’
  + Deep Blue also used an extended book, which contained information about 700 000 grandmaster matches and would direct Deep Blue in situations where the opening book wasn’t applicable. Moves found in the extended book would be given a bonus in the search tree, making it more likely that moves played by grandmasters would be chosen
  + The endgame database includes all chess positions with a maximum of 5 pieces on the board