

# ● Dynamic Programming ●

- Steps.
  - ✓ View the problem solution as the result of a sequence of decisions.
  - ✓ Obtain a formulation for the problem state.
  - ✓ Verify that the principle of optimality holds.
  - ✓ Set up the dynamic programming recurrence equations.
  - ✓ Solve these equations for the value of the optimal solution.
  - Perform a traceback to determine the optimal solution.

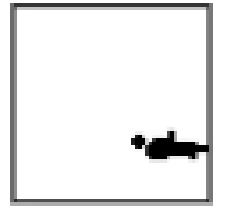


# Dynamic Programming



- When solving the dynamic programming recurrence recursively, be sure to avoid the recomputation of the optimal value for the same problem state.
- To minimize run time overheads, and hence to reduce actual run time, dynamic programming recurrences are almost always solved iteratively (no recursion).

# 0/1 Knapsack Recurrence



- If  $w_n \leq y$ ,  $f(n,y) = p_n$ .
- If  $w_n > y$ ,  $f(n,y) = 0$ .
- When  $i < n$ 
  - $f(i,y) = f(i+1,y)$  whenever  $y < w_i$ .
  - $f(i,y) = \max\{f(i+1,y), f(i+1,y-w_i) + p_i\}$ ,  $y \geq w_i$ .
- Assume the weights and capacity are integers.
- Only  $f(i,y)$ s with  $1 \leq i \leq n$  and  $0 \leq y \leq c$  are of interest.