2.1 S-metaheuristics
Local Search Algorithm (LS)

S-metaheuristics – Local Search Algorithm (LS)

Template of a local search algorithm.

Save ***S*** as ***best_solution***

$s = s_0$; /* Generate an initial solution s_0 */
While not Termination_Criterion **Do**
  Generate ($N(s)$) ; /* Generation of candidate neighbors */
  If there is no better neighbor **Then** Stop ;
  $s = s'$; /* Select a better neighbor $s' \in N(s)$ */
Endwhile
Output Final solution found (local optima).

Compare ***S*** with the ***best_solution*** and update if necessary

S-metaheuristics – Local Search Algorithm (LS)

One instance should be run multiple times

Template of a local search algorithm.

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S-metaheuristics – Local Search Algorithm (LS)

- Selection strategies of the neighbor
  - Best improvement (steepest descent)
    - Best neighbor is selected
    - Neighborhood evaluated in a fully deterministic manner
  - First improvement
    - First improving neighbor is selected
    - Partial evaluation of neighborhood
  - Random selection from those improving the solution

S-metaheuristics – Local Search Algorithm (LS)

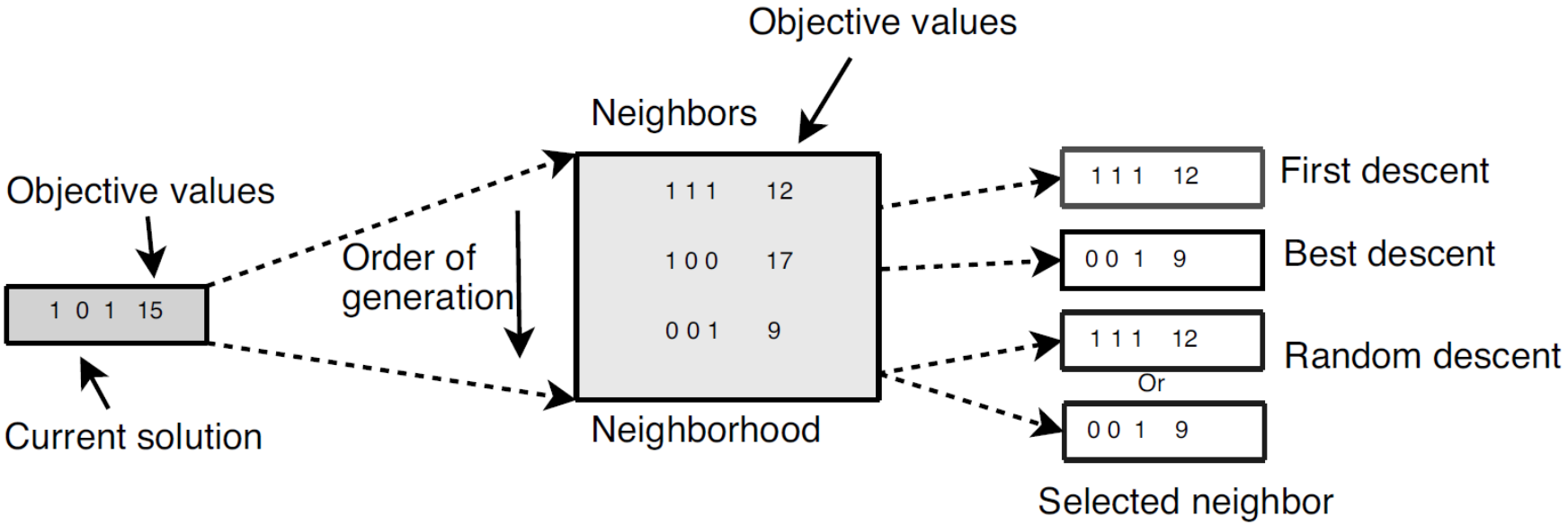

FIGURE Selection strategies of improving neighbors.

S-metaheuristics – Local Search Algorithm (LS)

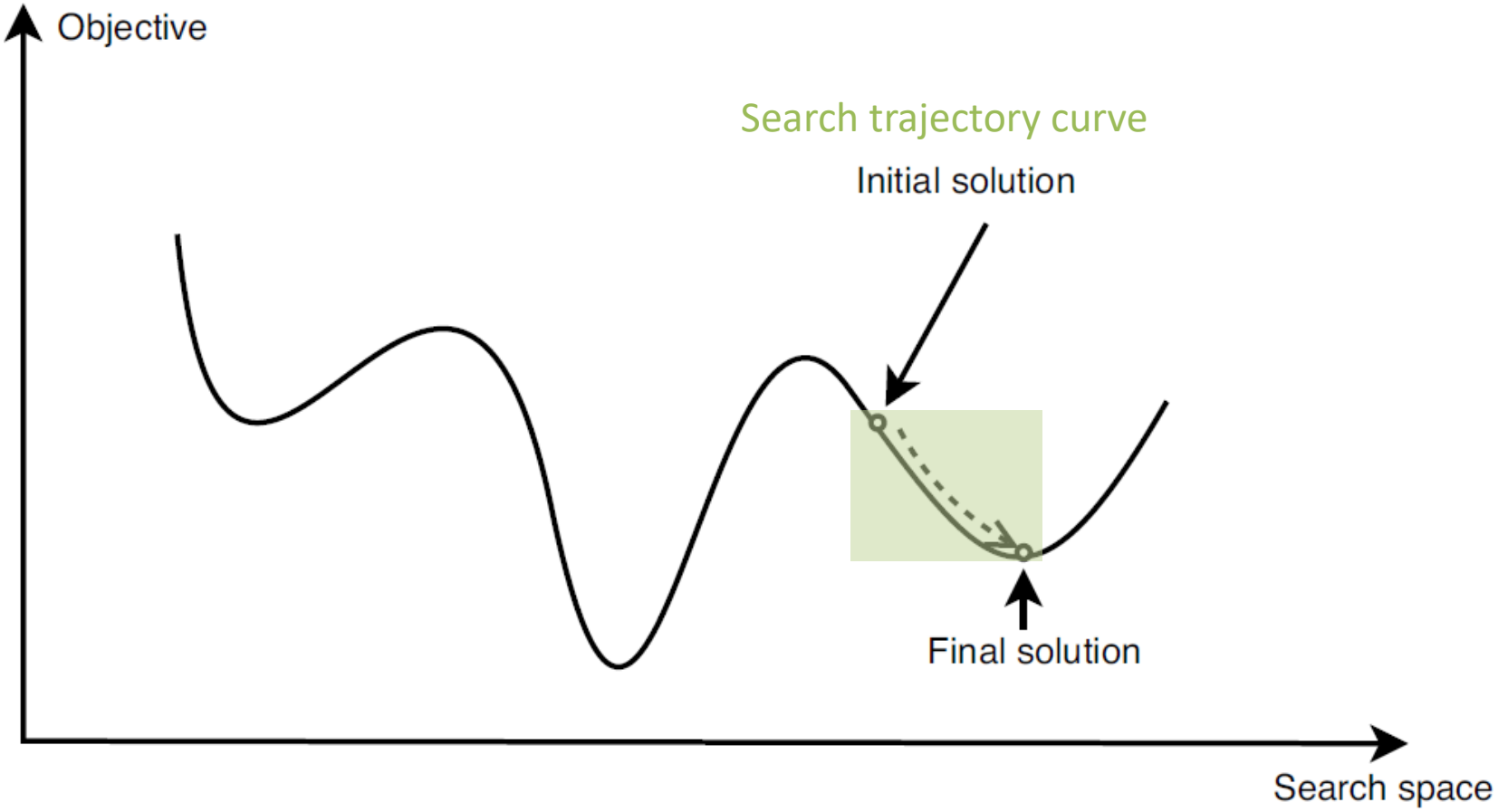

FIGURE Local search (steepest descent) behavior in a given landscape.

S-metaheuristics – Local Search Algorithm (LS)

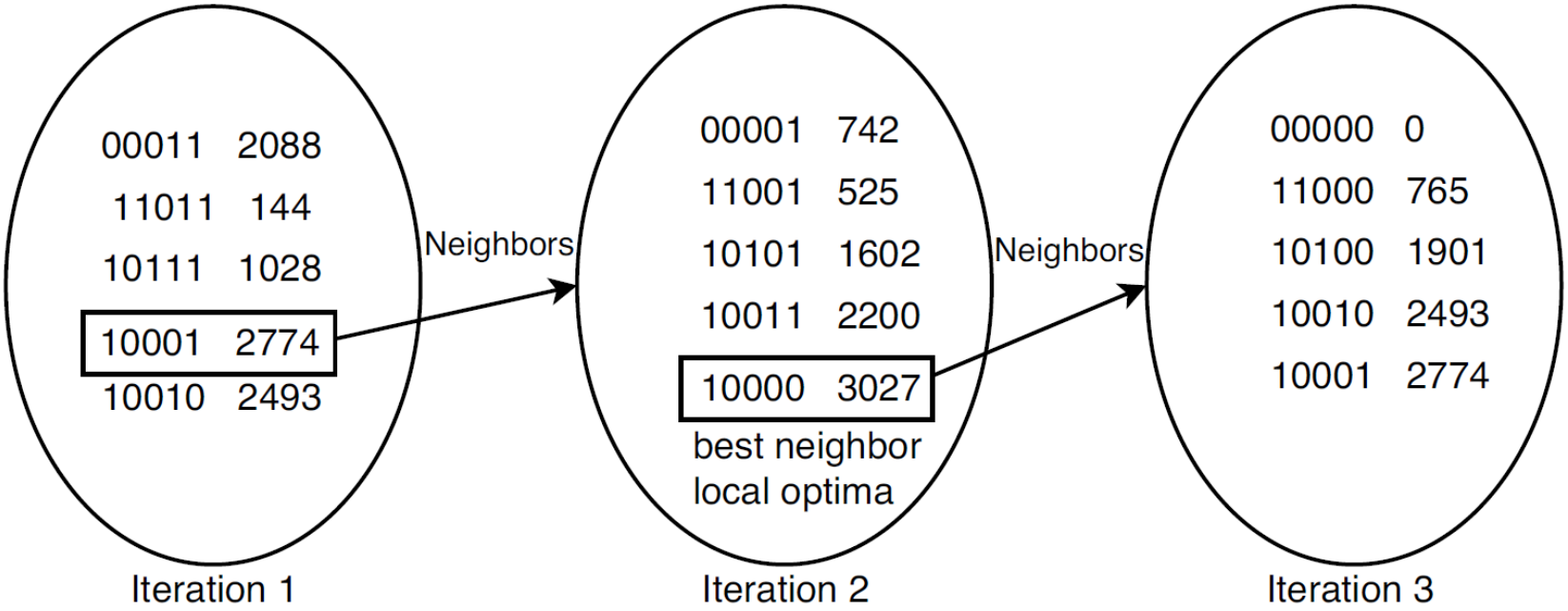

FIGURE Local search process using a binary representation of solutions, a flip move operator, and the best neighbor selection strategy. The objective function to maximize is $x^3 - 60x^2 + 900x$. The global optimal solution is $f(01010) = f(10) = 4000$, while the final local optima found is $s = (10000)$, starting from the solution $s_0 = (10001)$.

S-metaheuristics – Local Search Algorithm (LS)

- Advantages
  - Simple method and easy to design
  - Gives good solutions very quickly
- Drawbacks
  - Converges to local optima
  - Sensitive to initial solution
  - Number of iterations not known in advance

S-metaheuristics – Local Search Algorithm (LS)

- Lab session 

Implement your first S-metaheuristic algorithm – *The Local Search Algorithm (LS)*

– Develop the selection strategies and the neighborhood generation methods

– Apply it for

- The example of maximization function (slide 36, x in [0,31])
- Give the obtained solution for each selection strategy and neighborhood generation
- Show the associated search trajectory curve
- Test the TSP problem – Data available on teams