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Introduction

An efficient way to search for optima in oversubscribed scheduling problems is to include infeasible schedules in a search. Researchers have proposed two reasons for this efficiency:

- The best schedules are often nearly infeasible and occur in a region known as the *boundary region*.
- Infeasible schedules provide *short-cuts* to optimal solutions

Boundary-region efficiency has been documented, but short-cuts have not. This project focuses on identifying and measuring short-cuts in infeasible space.

What is a short-cut?

A short-cut is a series of infeasible changes that require fewer steps than if a search were restricted to feasible space.

What is a cycle?

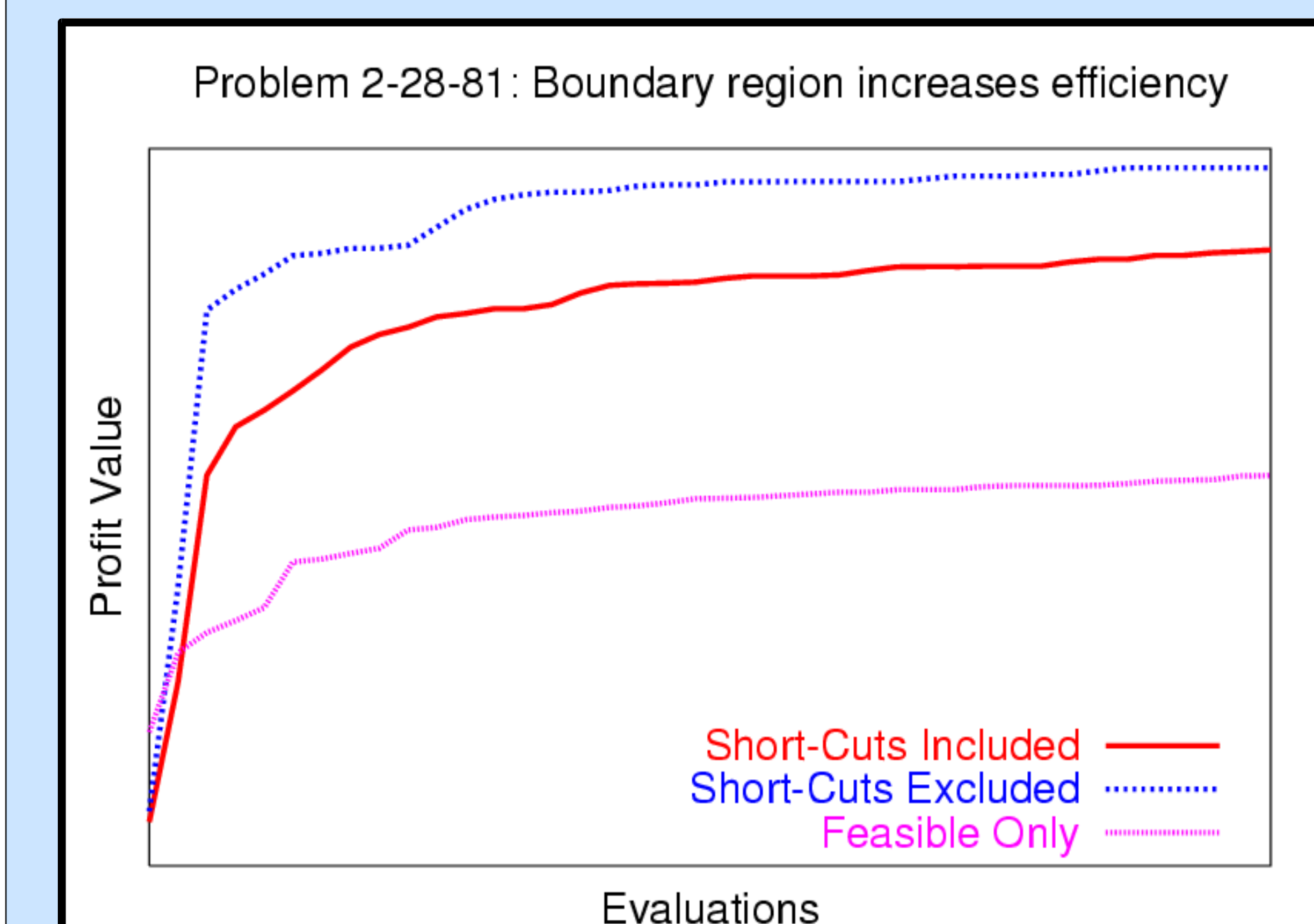
A cycle is a series of changes that does not alter a schedule.

What is a detour?

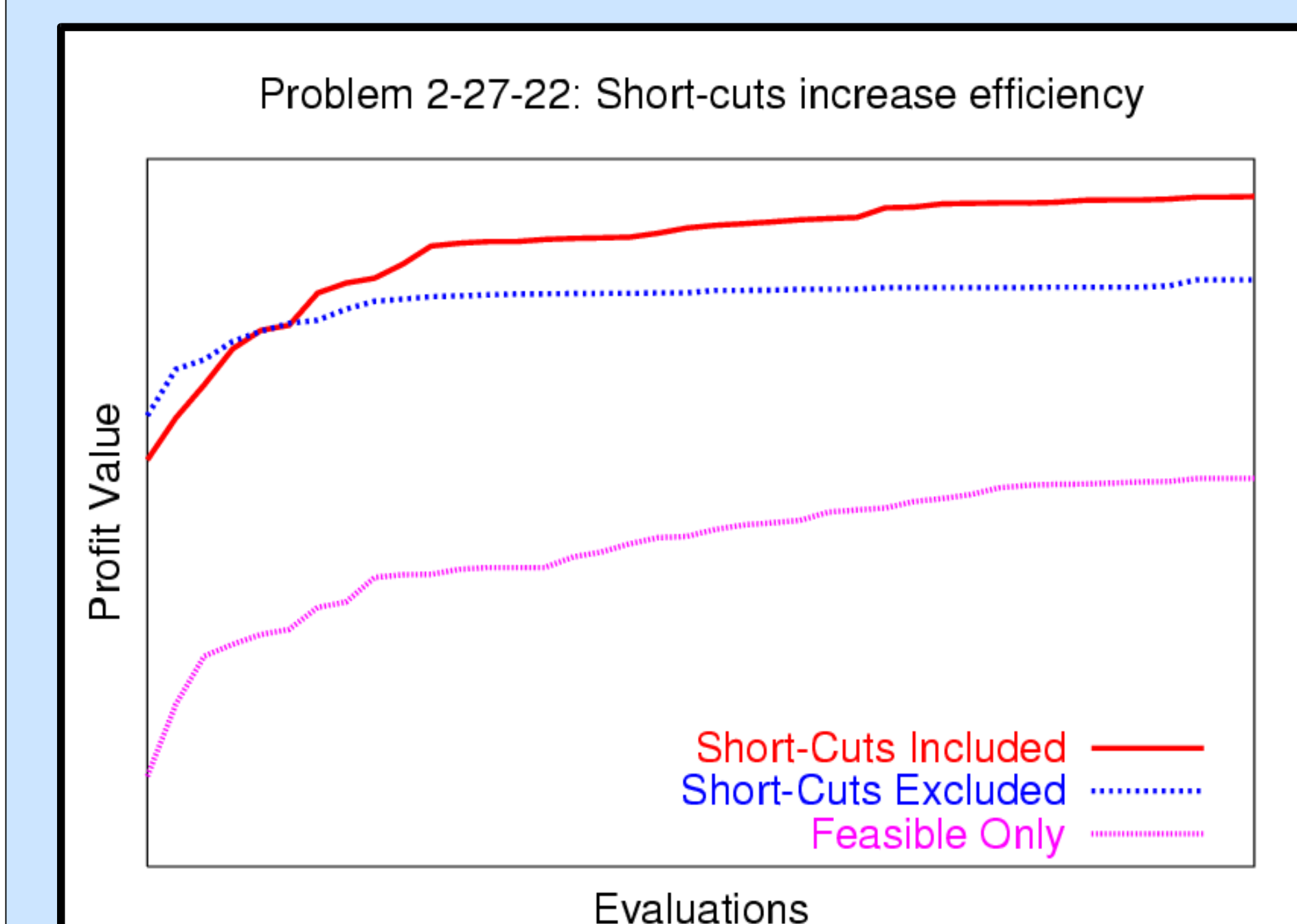
A detour is a series of changes that includes a cycle but alters a schedule. A detour may also be a short-cut.

Characterizing Efficiency

Results show that efficiency depends on the nature of the problem:



Efficiency comes from *boundary-region* search for some problems



Efficiency comes from *short-cuts* for others

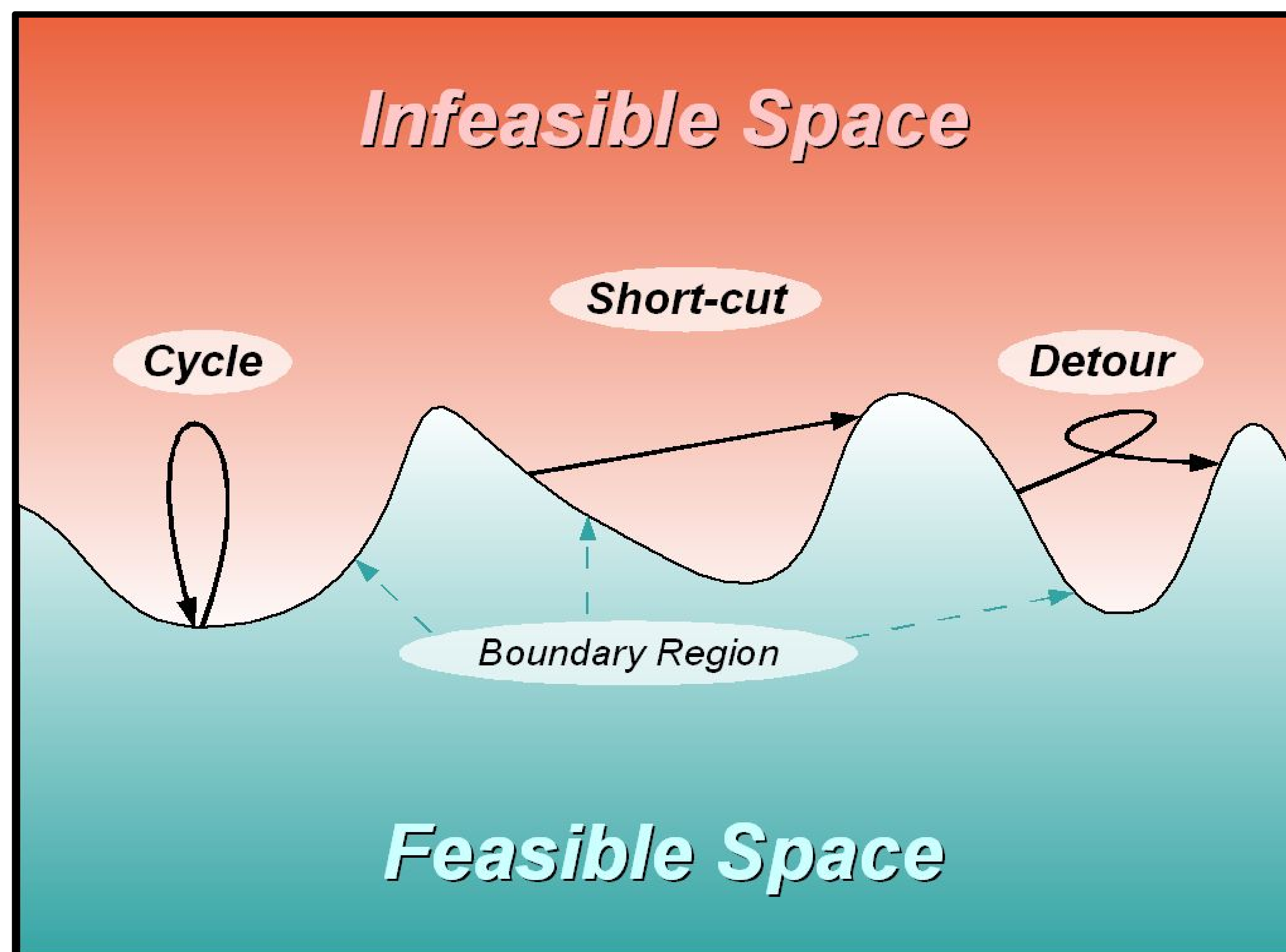
Comparing Efficiency

Experiments compare the efficiency of the following alternatives:

- Search feasible and infeasible space
- Focus search along boundary region and eliminate short-cuts
- Search only feasible space

Early results

- Confirmed that the original algorithm is most efficient when it searches infeasible space.
- Searches appear to find short-cuts but efficiency is problem-dependent.
- Searches encounter cycles and detours that impede efficiency.



Experiment Details

- Tabu search algorithm for satellite image scheduling:
 - Single-resource, over-subscribed
 - Searches both feasible and infeasible schedules
 - 16 test problems
- Alternate version focuses search along boundary region by restricting infeasible moves to 1 or 2 at a time.
- Feasible-only version eliminates infeasible schedules.

Future Work

Assess impact of detours and cycles:

- How often do they occur?
- How can we reduce/eliminate them?

Extend to other problems:

- EOS Scheduling
- Vehicle Routing