

# Harbor Logistics: Berth Allocation Problem for Inter-Related Terminals

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Introduction

BAP for Inter-Related ...

Objective

Model

Current Issues

Similar Problems

## Introduction

- Last decades: rapid grow of containerization
- Ports need methods to optimize logistics operations

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## BAP for Inter-Related Terminals

Consider:

- Port with a number of terminals
- Terminals are inter-connected
- Each terminal has a restricted quay length
- Each terminal has a restricted number of quay cranes
- Each terminal has a restricted storage capacity
- Vessels arrive once a week
- Vessels need to be unloaded and loaded
- Each specific vessel transports its specific containers

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## Objective

Assign arriving vessels to terminals by trading off:

1. Processing vessels within preferred time window,
2. Balancing the workload among the terminals and among the days,
3. Reducing inter-terminal transport.

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## Model

MILP formulation

Binary variables:

$$a_{tv}(k) \in \begin{cases} 1 & \text{if in terminal } t \text{ vessel } v \text{ arrives during } [k, k + 1), \\ 0 & \text{otherwise.} \end{cases}$$

$$d_{tv}(k) \in \begin{cases} 1 & \text{if in terminal } t \text{ vessel } v \text{ departs during } [k, k + 1), \\ 0 & \text{otherwise.} \end{cases}$$

$$b_{tv}(k) \in \begin{cases} 1 & \text{if in terminal } t \text{ vessel } v \text{ berths during } [k, k + 1), \\ 0 & \text{otherwise.} \end{cases}$$

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## Model

Continuous variables:

$q_{tv}(k)$  = Workload assigned in terminal  $t$  to vessel  $v$  during  $[k, k + 1)$ .

$f_{prz}(k)$  = Amount of containers transported from terminal  $p$  to terminal  $r$  with destination  $z$  during  $[k, k + 1)$ ,  $p \neq r$ .

$w_{tz}(k)$  = Number of containers in terminal  $t$  with destination  $z$  during  $[k, k + 1)$ .

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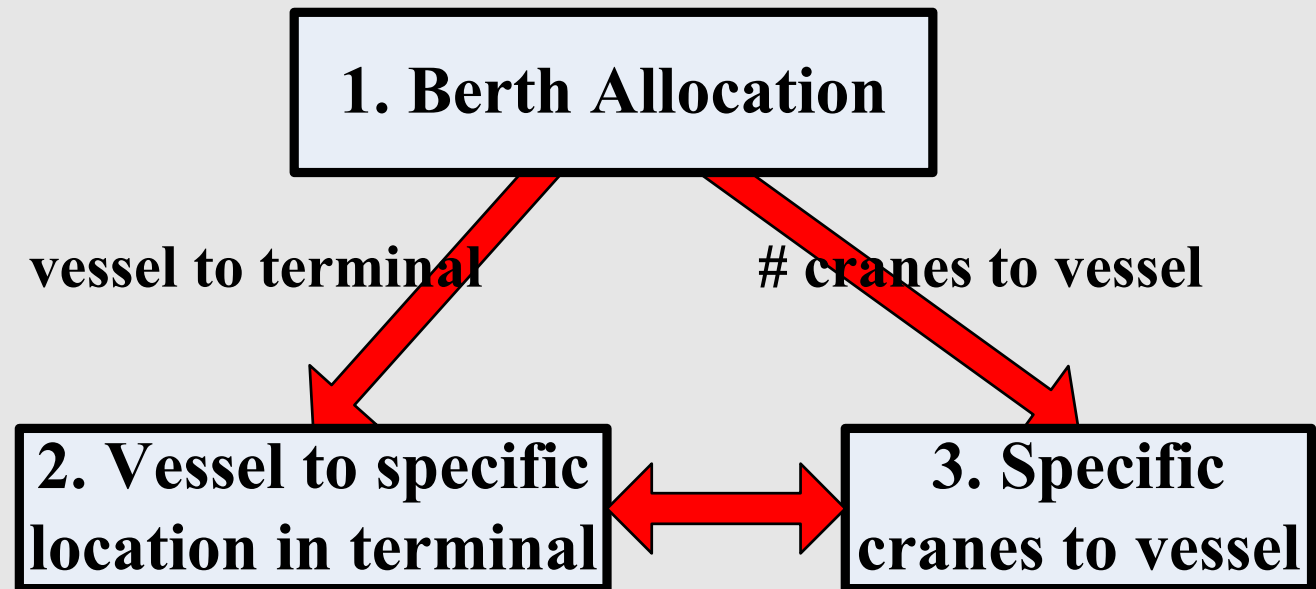
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## Current Issues

Find appropriate heuristics for 1 and 2+3.



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## Similar Problems

- BAP for 1 terminal: Tabu Search
- Cyclic Machine scheduling: Tabu Search
- Train scheduling: Decomposition Methods