

VU Research Portal

Dynamic Programming for Routing and Scheduling

van Hoorn, J.J.

2016

document version

Publisher's PDF, also known as Version of record

[Link to publication in VU Research Portal](#)

citation for published version (APA)

van Hoorn, J. J. (2016). *Dynamic Programming for Routing and Scheduling: Optimizing Sequences of Decisions*. Vrije Universiteit.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

E-mail address:

vuresearchportal.ub@vu.nl

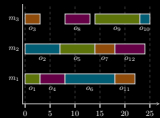
DYNAMIC PROGRAMMING FOR ROUTING AND SCHEDULING

OPTIMIZING SEQUENCES OF DECISIONS

JELKE J. VAN HOORN

Job 1			Job 2		
	$m(o)$	$p(o)$		$m(o)$	$p(o)$
o_1	1	3	o_2	2	7
o_5	2	7	o_6	1	10
o_9	3	9	o_{10}	3	2

Job 3			Job 4		
	$m(o)$	$p(o)$		$m(o)$	$p(o)$
o_3	3	3	o_4	1	5
o_7	2	4	o_8	3	5
o_{11}	1	4	o_{12}	2	6



- feasible
- optimal
- infeasible
- dominated
- bounded/feasible
- bounded/infeasible

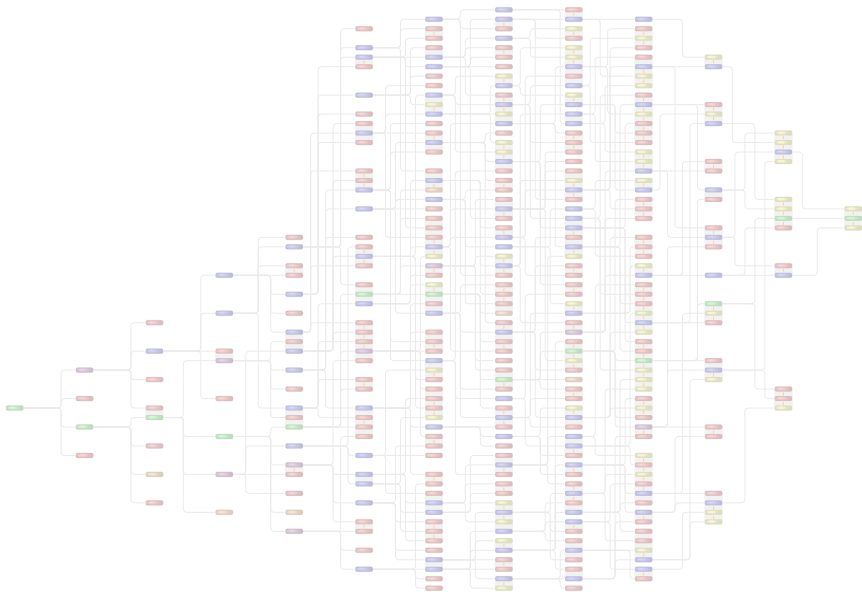
DYNAMIC PROGRAMMING FOR ROUTING AND SCHEDULING: OPTIMIZING SEQUENCES OF DECISIONS
JELKE J. VAN HOORN

JSSP

C_o	Finish time of operation o
j	Job
m	Machine
C_{max}	Makespan
p_{max}	Maximum operation time
o	Operation
$\pi_j(i)$	i -th machine job j has to visit
p_o	Processing time of operation o
ψ	Schedule
$\alpha(\zeta, o)$	Aptitude
$j(o)$	Job for operation o
$m(o)$	Machine for operation o
$\lambda(S)$	Last operation in S for each job
$\varepsilon(S)$	Next operation per job not in S
$p(o)$	Processing time for operation o
$\eta(\zeta)$	Possible expansions of ζ
$\Lambda(\zeta)$	Last operation in the sequence ζ
N	Number of jobs
M	Number of machines
\mathcal{J}	Set of jobs
\mathcal{M}	Set of machines
\mathcal{O}	Set of operations
\vec{a}	Array of aptitude values
$\vec{\eta}$	Array of possible expansions

JSSP Bounding

o^*	Current operation
h^{max}	First start of next maintenance
h^{min}	First end of prev maintenance
r_o	Head of operation o
\tilde{r}_o	temporary head of operation o
p_o^*	Remaining processing time
q_o	Tail of operation o
K^*	Maximal set creating a block
t	Current time
t^{req}	Next relevant time
\mathcal{A}	Set of available operations
\mathcal{D}	Set of delayed operations
\mathcal{U}	Set of unavailable operations
\mathcal{M}^*	Machines with operations left
\bar{I}	Set of all operations
I	Set of job operations
\bar{I}	Set of maintenance operations



DP

β	Bookkeeping variables
E	Number of expansions per solution
H	Number of expanded solutions
\triangleq	Domination: equal
\succeq	Domination: dominates
$\not\sim$	Domination: not comparable
\oplus	Expands solution with node
γ	Comparable variables
ϕ	Fixed variables
\prec	Precedence relation between nodes
Ω	Set identifiers of optimal solutions
ζ	A Solution
ζ^*	An optimal solution
$\zeta \oplus \gamma$	Splits ϕ and γ in a state definition
$\zeta \oplus \beta$	Splits γ and β in a state definition
ξ	State
ξ^*	Optimal solution
ξ	Non-dominated solutions

TSP

n	Number of nodes of a TSP problem
s	Start node of a TSP used in DP

VRP

d	Destination of a vehicle
o	Origin of a vehicle
r	Request
v	Vehicle
n	Number of customer requests
m	Number of vehicles
D	Set of destinations
O	Set of origins
R	Set of requests
V	Set of vehicles

JSSPM

D	Downtime
\vec{u}	Array of left uptime
u	Left uptime
R	Maintenance
U	Uptime
\mathcal{N}	Number of maintenances
\mathcal{R}	Set of maintenances