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Research article

A hybrid framework for multi-depot vehicle routing under stochastic demand: integrating adaptive redispatching with joint distribution

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Appendix A: Case information on joint distribution

Table A.1 Distribution center service customer points corresponding labels.

Distribution center	Service customer point
A	1-32
B	33-69
C	70-123

Table A.2 Point coordinates for the A-n33-k6 example.

Point	X	Y	Point	X	Y	Point	X	Y
A	-46	1	11	-71	36	22	1	16
1	-35	25	12	-79	14	23	5	-20
2	-10	50	13	-30	24	24	-5	-10
3	1	40	14	-45	15	25	-65	-9
4	5	31	15	-9	54	26	10	15
5	-21	25	16	-79	-21	27	-65	-30
6	-35	30	17	-55	24	28	-49	-4
7	-30	34	18	-35	29	29	-70	65
8	0	34	19	-35	41	30	-74	-24
9	-5	60	20	-14	54	31	-29	-25
10	-55	10	21	-69	5	32	-54	6

Table A.3 Point coordinates for the A-n38-k5 example.

Point	X	Y	Point	X	Y	Point	X	Y
B	-11	123	45	-5	149	58	-63	117
33	-77	95	46	-5	129	59	13	75
34	-9	139	47	17	155	60	-21	89
35	-79	107	48	-65	73	61	-45	99
36	-69	75	49	-17	155	62	-47	111
37	7	83	50	-33	101	63	-19	81
38	-43	93	51	-35	101	64	9	113
39	7	89	52	9	103	65	-47	145
40	-45	141	53	-35	119	66	-43	97
41	-25	131	54	15	83	67	-59	151
42	-39	111	55	-61	143	68	-13	155
43	13	69	56	-9	129	69	-19	75
44	-69	109	57	-53	79	/	/	/

Table A.4 Point coordinates for the A-n55-k9 example.

Point	X	Y	Point	X	Y	Point	X	Y
C	36	64	88	58	96	107	57	7
70	94	47	89	5	51	108	81	6
71	10	23	90	41	50	109	49	6
72	16	46	91	50	99	110	51	78
73	25	79	92	84	85	111	9	62
74	41	30	93	97	90	112	84	36
75	81	45	94	47	76	113	95	76
76	14	79	95	11	54	114	89	44
77	42	56	96	60	97	115	10	49
78	90	17	97	60	89	116	69	16
79	41	39	98	58	68	117	75	66
80	21	14	99	30	93	118	97	11
81	41	46	100	9	60	119	74	69
82	65	96	101	47	44	120	1	14
83	13	49	102	19	40	121	96	91
84	21	14	103	15	40	122	46	22
85	57	2	104	88	21	123	74	92
86	14	42	105	33	58	/	/	/
87	66	62	106	21	51	/	/	/

Table A.5 Actual demand from customers in three distribution centers.

Customer	Demand	Customer	Demand	Customer	Demand	Customer	Demand
1	26	32	22	63	7	94	23
2	17	33	12	64	3	95	19
3	6	34	5	65	2	96	15
4	15	35	8	66	24	97	22
5	7	36	12	67	13	98	7
6	5	37	18	68	14	99	11
7	15	38	12	69	14	100	15
8	16	39	11	70	3	101	22
9	17	40	19	71	12	102	12
10	1	41	23	72	25	103	24
11	21	42	8	73	4	104	25
12	66	43	25	74	11	105	2
13	25	44	1	75	20	106	15
14	16	45	5	76	21	107	18
15	11	46	17	77	10	108	13
16	7	47	13	78	20	109	3
17	17	48	9	79	13	110	20
18	17	49	13	80	14	111	14
19	22	50	19	81	16	112	10
20	10	51	5	82	17	113	10
21	25	52	26	83	11	114	66
22	16	53	9	84	36	115	10
23	7	54	20	85	6	116	7
24	21	55	21	86	7	117	12
25	11	56	8	87	21	118	24
26	21	57	12	88	11	119	5
27	11	58	13	89	17	120	18
28	21	59	12	90	22	121	7
29	22	60	4	91	10	122	11
30	25	61	19	92	19	123	12
31	2	62	25	93	21	/	/

Appendix B: Detailed route information

Table B.1 The vehicle route under the independent distribution model.

Route ID	Pre-optimization vehicle route	Vehicle route after redispatching	Route cost (yuan)	Total cost (yuan)
A1	A-17-11-29-**20**-**19**-**7**-A	A-17-11-29-**19**-**7**-A	301.14	
A2	A-22-8-3-**9**-**15**-**2**-A	A-22-8-3-**2**-A	249.69	
A3	A-14-1-18-6-13-A	A-14-1-18-6-13-A	103.51	
A4	A-5-4-26-24-23-31-A	A-5-4-26-24-23-31-**27**-**30**-**25**-A	362.83	1529.71
A5	A-21-12-16-**30**-**27**-**25**-A	A-21-12-16-A	196.38	
A6	A-10-32-28-A	A-**20**-10-32-28-A	214.79	
A7	/	A-**9**-**15**-A	101.37	
B1	B-33-36-48-57-69-63-60-B	B-**50**-33-36-48-57-69-63-60-B	292.56	
B2	B-49-40-65-67-55-35-44-58-B	B-49-40-65-67-55-35-44-58-B	304.19	
B3	B-53-42-62-61-66-38-51-**50**-B	B-53-42-62-61-66-38-51-B	161.55	1330.82
B4	B-64-52-54-59-**43**-**37**-**39**-B	B-64-52-54-59-**39**-**37**-B	190.79	
B5	B-56-46-45-47-68-34-41-B	B-56-46-45-47-68-34-41-B	200.45	
B6	/	B-**43**-B	181.28	
C1	C-117-70-113-93-121-92-C	C-117-108-70-113-93-121-92-C	264.45	
C2	C-99-91-88-96-82-98-C	C-99-91-88-96-82-98-C	176.40	
C3	C-72-86-83-115-89-95-C	C-72-86-83-115-89-95-C	120.71	
C4	C-71-120-109-85-107-116-112-C	C-**79**-**74**-71-120-109-85-107-116-112-C	329.18	
C5	C-87-119-123-97-110-94-C	C-87-119-123-97-110-94-C	169.47	1961.57
C6	C-105-81-101-90-77-C	C-105-106-81-101-90-77-C	78.03	
C7	C-102-103-84-80-122-**74**-**79**-C	C-102-103-84-80-122-C	195.41	
C8	C-75-114-104-78-118-**108**-C	C-75-114-104-78-118-C	275.70	
C9	C-73-76-**111**-**100**-**106**-C	C-73-76-**100**-C	126.26	
C10	/	C-**111**-C	225.96	
Total			4822.10	

Note: Customer points marked in blod are failure points in the pre-optimization phase.

Table B.2 The vehicle route under the joint distribution model.

Route ID	Pre-optimization vehicle route	Vehicle route after redispatching	Route cost (yuan)	Total cost (yuan)
A1	A-14-19-11-12-21-A	A-14-19-11-12-21-A	207.68	
A2	A-2-20-15-9-3-A	A-2-20-15-9-3-A	240.95	
A3	A-31-23-24-120-22-4-8-A	A-31-23-24-120-22-4-8-A	276.42	1106.34
A4	A-28-27-30-16-25-A	A-28-27-30-16-25-A	139.38	
A5	A-32-10-17-1-A	A-32-10-17-1-A	110.97	
A6	A-18-6-7-5-13-A	A-18-6-7-5-13-A	130.94	
B1	B-56-46-34-45-68-49-41-B	B-56-46-34-45-68-49-41-B	130.94	
B2	B-62-33-36-29-48-57-69-**63**-B	B-62-33-36-29-48-57-69-B	314.07	
B3	B-58-44-35-55-67-65-40-B	B-58-44-35-55-67-65-40-B	266.10	1255.54
B4	B-47-64-52-39-37-60-B	B-47-64-52-39-**54**-37-60-B	269.24	
B5	B-50-51-38-66-61-42-53-B	B-50-51-38-66-61-42-53-B	146.93	
B6	/	B-**63**-B	128.26	
C1	C-123-121-93-113-92-C	C-123-121-93-113-92-C	227.09	
C2	C-106-95-100-111-43-59-76-**54**-C	C-106-95-100-111-43-59-76-C	133.76	
C3	C-102-103-86-72-83-115-C	C-102-103-86-72-83-115-C	116.07	
C4	C-74-122-80-84-26-C	C-74-122-80-84-26-C	204.84	
C5	C-73-99-91-88-96-82-97-C	C-73-99-91-88-96-82-97-C	170.22	1679.13
C6	C-87-117-119-98-110-94-C	C-87-117-119-98-110-94-C	138.11	
C7	C-105-90-81-79-101-77-C	C-105-90-81-79-101-77-C	89.75	
C8	C-89-71-109-107-85-108-116-C	C-89-71-109-107-85-108-116-C	323.81	
C9	C-75-114-70-118-78-104-112-C	C-75-114-70-118-78-104-112-C	275.48	
Total			4041.01	

Note: Customer points marked in bold are failure points in the pre-optimization phase.



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