

9 Supplementary Materials

9.1 Supplementary Methods

We include flowcharts for the heuristics used in our study. The set of hyperparameters used to train the RL agents is included in Table 3.

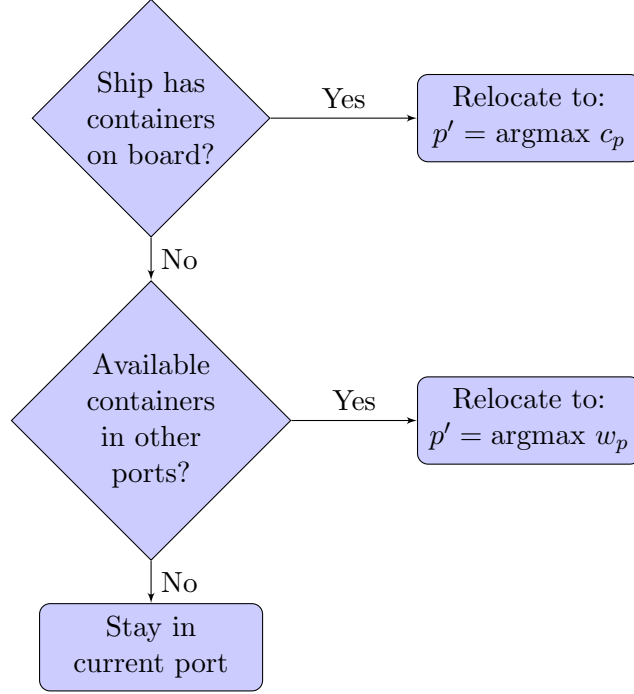


Figure 9: Capacity heuristic.

Hyperparameter	Value	Description
λ	0.95	Generalized Advantage Estimator
α	0.0003	Learning rate
γ	0.998	Discount factor
Batch size	64	Mini-batch size
No. of envs	28	Number of parallel environments
No. of steps	512	Number of steps to run for each environment for each update
Network layers	128-64-32	Number of nodes in each layer of the neural network
Activation function	TanH	Activation function of each node in the neural network

Table 3: PPO hyperparameters.

9.1.1 Reward Function

In our exploration of reward functions, we experimented with several approaches. These included providing the agent with a reward not only when successfully delivering containers on time but

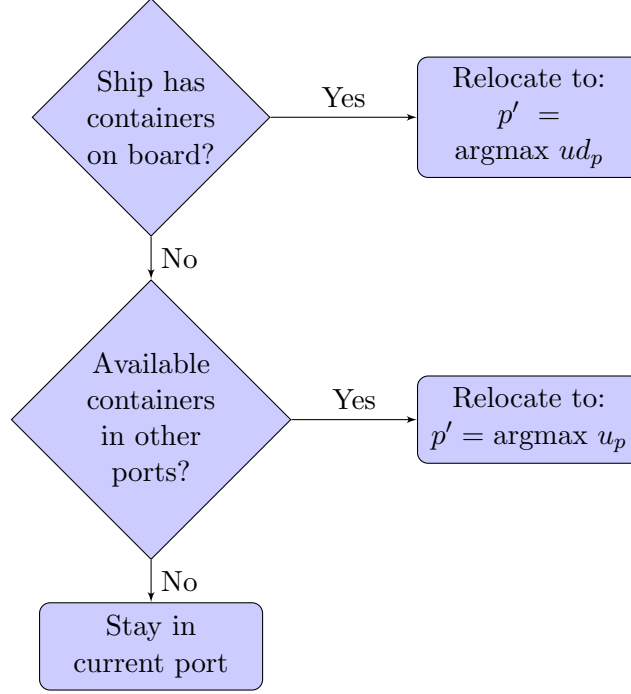


Figure 10: Urgency heuristic.

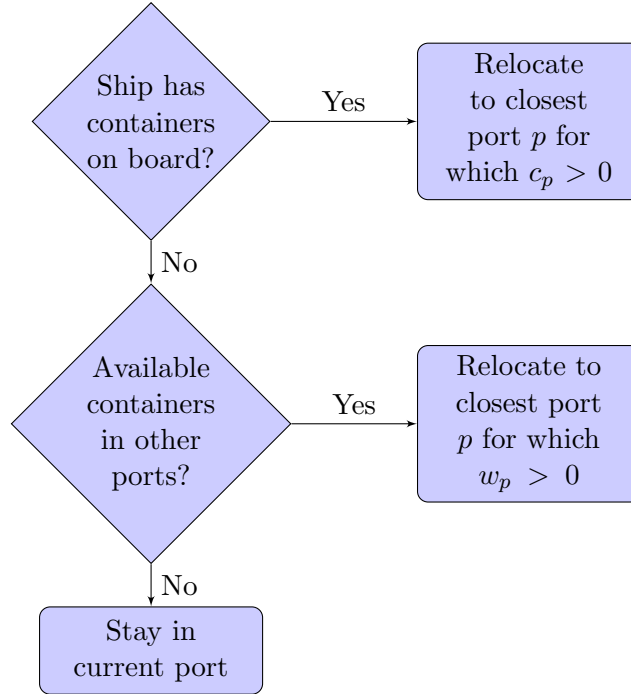


Figure 11: Closeness heuristic.

also when it loads them. Another approach involved rewarding the agent only at the end of an episode, reflecting its overall performance, such as the ratio of containers delivered to transportation

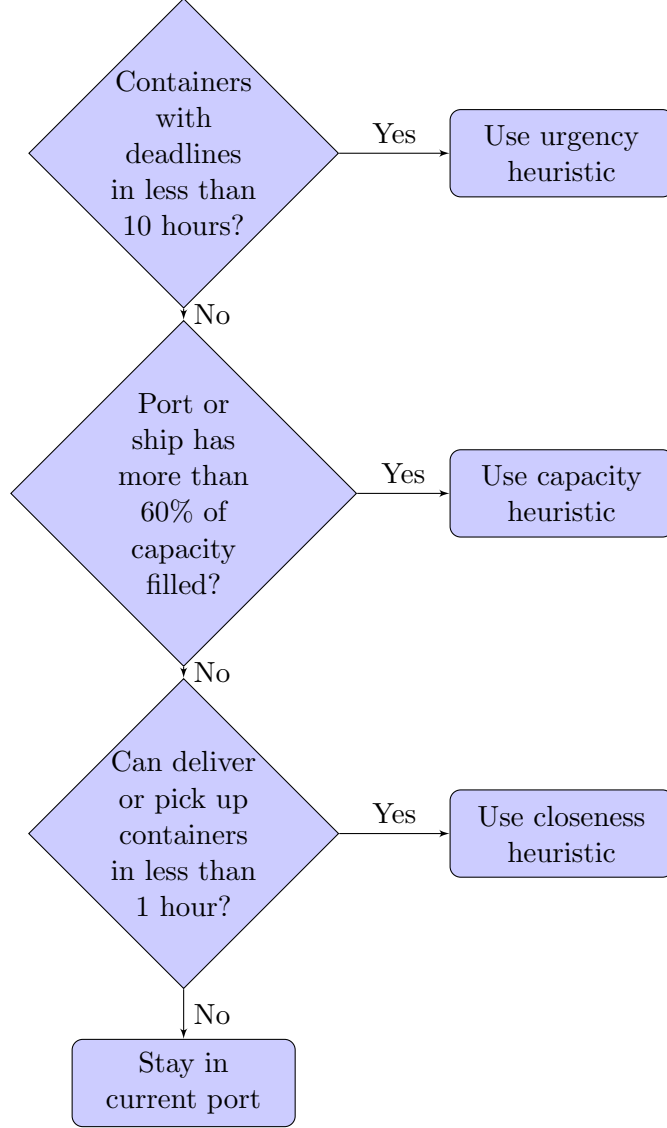


Figure 12: Hybrid heuristic.

costs or the number of stops made. Our findings indicated that the latter approach results greater challenges for learning, primarily due to the extended duration of episodes. It is, therefore, more effective to offer the agent feedback (reward) after each action rather than at the end of the episode.

Furthermore, our research revealed that a successful training strategy involved initially training the agent with a specific reward function, such as the number of containers delivered. Subsequently, once a policy was learned, we retrained the agent using a reward function that also involves in penalties for transportation costs. This two-stage approach allowed the agent to adapt its policy to reduce transportation costs while still maintaining a high level of on-time container deliveries.

9.2 Supplementary Results

Following, we report the full results for all models evaluated (random policy, RL agents 0, 1, 2a, 2b and capacity, urgency, closeness, and hybrid heuristics). We also provide results for the uniform and demand spike cases as well as different size of fleet.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1676.05	2349.15	3558.60	3641.30	4174.65	5462.70	5559.45	6086.90	7413.65
Delivered	1016.00	1260.85	1636.55	2562.30	2728.70	2855.05	3910.60	3842.35	3814.80
Delivered (%)	60.98	53.67	46.14	70.45	65.40	52.41	70.36	63.19	51.54
Delivered late	319.15	369.20	541.55	1054.60	1064.65	1133.45	1912.40	1816.90	1965.45
Late containers	508.75	647.00	916.30	1642.70	1651.25	2027.65	3001.05	3085.60	3645.75
Late containers (%)	30.35	27.54	25.74	45.11	39.55	37.11	53.98	50.69	49.17
St. dev. of late containers	57.28	68.58	155.79	163.19	206.48	190.46	263.61	206.03	239.20
Capacity filled (%)	23.37	27.77	34.73	53.04	54.55	59.76	76.57	76.78	83.29
Average lateness (min)	1140.56	1066.80	1106.91	1302.79	1226.38	1176.18	1281.22	1296.46	1303.92
Relocations	887.30	881.35	864.65	869.10	860.60	851.55	834.35	829.25	830.40
Cost	61818.64	61459.92	60876.58	59972.63	59748.77	59045.79	58173.69	58127.48	57674.15
St. dev of costs	423.09	407.15	422.70	487.16	344.50	359.54	367.45	426.18	558.99

Table 4: Random policy.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1651.10	2367.90	3715.30	3676.15	4341.80	5893.10	5699.45	6417.95	7817.90
Delivered	1120.85	1385.85	2063.35	2793.75	3056.90	3874.80	4428.85	4823.30	5324.65
Delivered (%)	67.80	58.48	55.55	76.07	70.43	65.81	77.75	75.10	68.11
Delivered late	87.45	85.10	103.40	119.25	147.85	184.70	254.10	280.15	349.65
Late containers	259.35	301.15	367.60	543.55	592.95	657.95	1008.95	993.70	1223.20
Late containers (%)	15.71	12.71	9.89	14.78	13.65	11.16	17.77	15.48	15.64
St. dev. of late containers	51.41	48.66	80.06	55.21	72.86	107.69	111.57	198.89	171.78
Capacity filled (%)	9.78	11.63	15.60	20.46	22.83	27.12	35.37	36.30	40.76
Average lateness	868.87	897.98	1085.93	982.61	1210.06	1122.20	986.12	910.73	927.87
Relocations	631.85	639.50	576.70	670.15	681.30	623.20	693.05	651.90	698.30
Cost	54397.09	55920.37	55275.60	53681.73	52710.65	54206.54	51296.08	50582.28	50593.56
St. dev of costs	4565.61	3557.14	2991.29	1880.07	2538.78	1798.29	2000.93	2226.06	1531.86

Table 5: RL agent 0.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1694.20	2423.20	3812.80	3752.80	4451.40	6206.60	5834.40	6578.40	7998.80
Delivered	1423.80	1804.40	2612.20	3434.40	3813.20	4986.00	5461.40	5915.80	6712.20
Delivered (%)	84.16	74.59	68.63	91.54	85.68	80.28	93.64	89.96	83.92
Delivered late	0.00	0.00	0.00	0.00	0.00	0.00	1.9	0.00	1.3
Late containers	0	0	0	0	0	0	1.9	0	1.3
Late containers (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.02
St. dev of late containers	0.00	0.00	0.00	0.00	0.00	0.00	7.60	0.00	5.20
Capacity filled (%)	4.65	5.97	8.51	10.32	11.73	16.03	17.04	18.53	23.82
Average lateness	0.00	0.00	0.00	0.00	0.00	0.00	201.98	0.00	34.25
Relocations	2631.40	2114.40	1823.80	1706.20	1535.60	1310.60	1542.60	1360.20	1208.60
Cost	63161.34	62888.31	62098.69	60995.25	60565.82	59686.86	58964.31	58510.18	57485.51
St. dev of costs	154.64	135.15	156.09	375.44	363.66	248.17	159.10	449.24	373.71

Table 6: RL agent 1.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1691.20	2410.35	3707.30	3706.40	4486.45	5778.55	5734.70	6479.20	7879.30
Delivered	1317.60	1753.75	2486.65	3348.15	3798.70	4560.50	5373.65	5805.25	6630.55
Delivered (%)	77.95	72.88	67.02	90.33	84.66	78.96	93.73	89.64	84.17
Delivered late	22.75	12.80	4.10	11.50	2.50	2.65	33.80	33.75	30.75
Late containers	27.40	13.05	4.1	14.45	3.5	2.65	53.15	37.25	32.45
Late containers (%)	1.62	0.54	0.11	0.39	0.08	0.05	0.93	0.57	0.41
St. dev. of late containers	50.19	28.11	9.34	30.88	5.70	4.68	97.51	96.50	45.57
Capacity filled (%)	7.50	8.14	10.21	12.99	13.40	15.76	20.43	21.06	24.38
Average lateness	66.20	83.50	58.67	99.45	94.82	187.87	322.63	130.73	225.83
Relocations	781.75	920.45	1052.40	1070.80	1112.50	1187.50	1139.45	1166.45	1163.25
Cost	31291.02	37078.89	43179.48	45133.94	46917.60	50626.18	49217.97	49880.64	50099.40
St. dev. of costs	6257.94	4992.32	3831.55	3564.60	2490.30	2564.39	2370.90	2160.30	2698.35

Table 7: RL agent 2a.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1692.05	2390.60	3956.95	3667.10	4471.70	5833.60	5780.20	6405.90	7857.25
Delivered	1340.10	1665.95	2570.25	3273.85	3754.75	4493.75	5384.00	5724.65	6569.00
Delivered (%)	79.24	69.81	65.00	89.31	84.00	77.14	93.19	89.37	83.65
Delivered late	14.25	15.11	9.70	6.25	0.60	4.10	6.95	6.45	11.70
Late containers	14.25	15.11	9.70	6.25	0.60	4.10	6.95	6.45	11.70
Late containers (%)	0.84	0.63	0.25	0.17	0.01	0.07	0.12	0.10	0.15
St. dev. of late containers	16.33	17.85	13.24	8.69	1.53	7.96	9.07	11.20	12.66
Capacity filled (%)	14.21	15.92	19.52	20.46	22.22	23.56	25.58	26.46	28.31
Average lateness	112.80	175.53	91.32	26.51	31.81	51.39	97.91	58.57	46.00
Relocations	434.95	501.90	673.70	772.80	844.05	966.55	1032.10	1075.15	1176.95
Cost	14323.58	17512.89	23064.90	28233.53	30435.92	34727.54	37953.09	39169.16	42792.09
St. dev. of costs	1723.04	2642.89	2346.01	2715.48	2779.83	2515.61	1502.83	2477.60	1332.95

Table 8: RL agent 2b.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1714.80	2352.55	3752.00	3681.35	4429.75	5840.30	5703.15	6477.35	7934.15
Delivered	1413.50	1781.80	2576.95	3396.65	3819.30	4678.75	5439.25	5872.15	6705.30
Delivered (%)	82.54	75.73	68.68	92.32	86.29	80.17	95.39	90.70	84.54
Delivered late	0.20	0.25	4.90	17.30	26.95	50.55	101.75	125.05	236.90
Late containers	0.20	0.25	4.90	17.30	26.95	50.55	101.75	125.05	236.90
Late containers (%)	0.01	0.01	0.18	0.51	0.71	1.08	1.87	2.13	3.54
St. dev. of late containers	0.87	0.62	8.31	17.68	23.26	34.98	41.28	45.25	88.02
Capacity filled (%)	0.34	0.50	1.04	1.86	2.50	3.71	5.75	6.76	9.83
Average lateness	7.55	95.70	370.09	846.66	847.12	972.45	1165.26	1270.01	1330.67
Relocations	518.45	570.35	600.10	617.95	620.55	623.55	596.55	605.80	591.95
Cost	51094.07	54340.63	56693.46	56110.46	57643.35	56727.57	54893.24	55966.92	54562.33
St. dev of costs	6280.42	6430.44	2805.22	3727.89	1760.24	1243.16	2571.09	1206.25	1079.50

Table 9: Capacity heuristic.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1772.50	2338.30	3748.65	3665.10	4480.90	5848.80	5750.10	6436.35	7716.95
Delivered	1430.35	1767.60	2489.55	3386.30	3858.50	4563.20	5422.00	5824.70	6511.55
Delivered (%)	80.99	75.73	66.47	92.47	86.18	78.09	94.31	90.50	84.40
Delivered late	0.00	0.00	0.00	0.00	0.00	9.60	0.00	28.85	1.00
Late containers	0	0	0	0	0	9.60	0	28.85	1.00
Late containers (%)	0	0	0	0	0	0.20	0	0.48	0.02
St. dev of late containers	0.00	0.00	0.00	0.00	0.00	41.85	0.00	99.54	4.36
Capacity filled (%)	0.39	0.80	1.57	3.96	4.39	6.91	10.04	11.67	15.26
Average lateness	0.00	0.00	0.00	0.00	0.00	24.35	0.00	19.33	2.20
Relocations	543.85	585.70	603.85	608.05	622.45	618.50	605.80	620.20	618.60
Cost	51999.36	56805.22	56776.41	55718.72	56938.38	56063.33	54235.00	55217.46	53897.04
St. dev of costs	2988.77	1962.06	1600.86	1535.59	1615.32	505.20	1652.22	922.97	617.86

Table 10: Urgency heuristic.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1804.50	2591.20	4032.35	3853.70	4729.55	6419.10	5968.25	6983.30	8470.05
Delivered	1505.30	2013.85	2844.30	3558.30	4137.00	5160.85	5698.85	6306.60	7236.25
Delivered (%)	83.50	77.79	70.65	92.36	87.54	80.41	95.50	90.34	85.45
Delivered late	5.55	1.35	8.55	27.75	61.65	60.50	163.80	172.85	167.15
Late containers	5.55	1.35	8.55	27.75	61.65	60.50	163.80	172.85	167.15
Late containers (%)	0.35	0.07	0.29	0.78	1.48	1.17	2.88	2.74	2.31
St. dev of late containers	24.19	4.69	18.59	30.28	49.81	44.71	97.34	102.86	69.61
Capacity filled (%)	0.71	1.26	2.24	2.21	3.25	4.94	5.95	6.76	9.76
Average lateness	6.44	31.60	58.47	1063.42	1285.42	1229.07	2277.01	2097.87	2002.65
Relocations	538.30	603.70	690.55	675.80	716.30	760.35	698.25	737.15	785.60
Cost	50747.99	54263.94	58252.61	56004.65	58280.33	59461.54	55340.98	57290.51	57789.18
St. dev of costs	4317.40	2179.48	788.66	2058.53	1603.17	477.06	1671.42	1346.81	328.00

Table 11: Closeness heuristic.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1753.50	2438.25	3852.75	3683.35	4409.10	5741.30	5700.25	6388.65	7741.00
Delivered	1365.75	1652.05	2349.45	3286.20	3630.20	4369.45	5306.35	5648.30	6191.75
Delivered (%)	78.12	67.82	61.04	89.26	82.41	76.19	93.12	88.43	79.98
Delivered late	0.00	1.75	18.00	1.40	14.50	10.20	51.50	45.65	107.80
Late containers	0.00	1.75	18.00	1.40	14.50	10.20	51.50	45.65	107.80
Late containers (%)	0.00	0.11	0.69	0.04	0.44	0.23	1.01	0.83	1.84
St. dev of late containers	0.00	7.63	47.56	4.90	44.14	16.33	129.58	85.96	193.39
Capacity filled (%)	9.04	10.46	15.37	19.32	20.37	25.18	29.95	29.71	34.92
Average lateness	0.00	0.53	33.55	18.96	33.73	32.06	252.57	111.67	149.69
Relocations	357.50	388.75	439.30	484.50	529.20	509.10	598.65	577.90	619.75
Cost	25930.31	27851.84	30149.48	34210.61	35400.94	36312.66	38846.78	39526.39	40250.03
St. dev of costs	2425.80	2461.60	3057.84	2537.10	2546.64	1992.02	3790.31	3833.01	3256.81

Table 12: Hybrid heuristic.

	1000			3000			5000		
λ^r	0.5	1	2	0.5	1	2	0.5	1	2
Random Policy	1676.05	2349.15	3558.60	3641.30	4174.65	5462.70	5559.45	6086.90	7413.65
Urgency Heuristic	1772.50	2338.30	3748.65	3665.10	4480.90	5848.80	5750.10	6436.35	7716.95
Capacity Heuristic	1714.80	2352.55	3752.00	3681.35	4429.75	5840.30	5703.15	6477.35	7934.15
Closeness Heuristic	1804.50	2591.20	4032.35	3853.70	4729.55	6419.10	5968.25	6983.30	8470.05
Hybrid Heuristic	1753.50	2438.25	3852.75	3683.35	4409.10	5741.30	5700.25	6388.65	7741.00
RL Agent 0	1651.10	2367.90	3715.30	3676.15	4341.80	5893.10	5699.45	6417.95	7817.90
RL agent 1	1694.20	2423.20	3812.80	3752.80	4451.40	6206.60	5834.40	6578.40	7998.80
RL agent 2a	1691.20	2410.35	3707.30	3706.40	4486.45	5778.55	5734.70	6479.20	7879.30
RL Agent 2b	1692.05	2390.60	3956.95	3667.10	4471.70	5833.60	5780.20	6405.90	7857.25

Table 13: Total number of containers handled by different agents in various scenarios.

	1000			3000			5000		
λ^r	0.5	1	2	0.5	1	2	0.5	1	2
Random Policy	30.35%	45.11%	53.98%	27.54%	39.55%	50.69%	25.74%	37.11%	49.17%
Urgency Heuristic	0.00%	0.04%	1.01%	0.11%	0.44%	0.83%	0.69%	0.23%	1.84%
Capacity Heuristic	0.01%	0.18%	1.87%	0.63%	0.71%	2.13%	0.29%	1.08%	3.54%
Closeness Heuristic	0.35%	0.07%	0.29%	0.78%	1.48%	1.17%	2.88%	2.74%	2.31%
Hybrid Heuristic	0.00%	0.11%	0.69%	0.04%	0.44%	0.23%	1.01%	0.83%	1.84%
RL Agent 0	15.71%	14.78%	17.77%	12.71%	13.65%	15.48%	9.89%	11.16%	15.64%
RL agent 1	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.02%	0.00%	0.02%
RL agent 2a	0.84%	0.54%	0.11%	0.39%	0.08%	0.05%	0.93%	0.57%	0.41%
RL Agent 2b	0.84%	0.17%	0.12%	0.00%	0.01%	0.07%	0.15%	0.10%	0.02%

Table 14: Percentage of late containers for different agents in various scenarios.

	1000			3000			5000		
λ^r	0.5	1	2	0.5	1	2	0.5	1	2
Random Policy	61818.64	59972.63	58173.69	61459.92	59748.77	58127.48	60876.58	59045.79	57674.15
Urgency Heuristic	25930.31	34210.61	38846.78	27851.84	35400.94	39526.39	30149.48	36312.66	40250.03
Capacity Heuristic	51094.07	54340.63	56693.46	56110.46	57643.35	56727.57	54893.24	55966.92	54562.33
Closeness Heuristic	50747.99	54263.94	58252.61	56004.65	58280.33	59461.54	55340.98	57290.51	57789.18
Hybrid Heuristic	25930.31	34210.61	38846.78	27851.84	35400.94	39526.39	30149.48	36312.66	40250.03
RL Agent 0	54397.09	55920.37	55275.60	53681.73	52710.65	54206.54	51296.08	50582.28	50593.56
RL agent 1	63161.34	60995.25	58964.31	62888.31	60565.82	58510.18	62437.98	60168.77	58150.82
RL agent 2a	49792.34	57725.65	66762.75	54013.34	59854.99	64110.87	57650.52	61795.39	62967.99
RL Agent 2b	14323.58	28233.53	37953.09	17512.89	30435.92	34727.54	23245.68	33783.35	38039.13

Table 15: Total cost for different agents in various scenarios.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1737.20	2397.50	3768.00	3706.30	4493.20	5875.40	5787.25	6489.05	7988.85
Delivered	1426.60	1800.40	2567.15	3445.85	3935.00	4677.35	5467.05	5706.60	6750.25
Delivered (%)	82.29	75.28	68.19	93.00	87.61	79.65	94.48	87.86	84.52
Delivered late	0.00	0.00	0.00	0.00	0.00	0.00	18.00	40.50	37.00
Late containers	0.00	0.00	0.00	0.00	0.00	0.00	18.00	40.50	37.00
Late containers (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.69	0.46
St. dev. of late containers	0.00	0.00	0.00	0.00	0.00	0.00	71.71	121.71	120.22
Capacity filled (%)	3.24	4.26	7.06	9.08	10.62	12.91	16.96	21.62	21.28
Average lateness	0.00	0.00	0.00	0.00	0.00	0.00	36.40	83.12	60.42
Relocations	2071.85	2022.30	1861.10	1761.60	1713.45	1599.80	1586.65	1552.55	1436.50
Cost	61502.02	61271.94	60322.64	59649.65	59013.19	58130.65	57386.76	56216.01	55593.30
St. dev. of costs	464.44	612.51	662.81	631.47	449.29	516.22	453.42	1972.55	884.88

Table 16: RL agent 1 - uniform demand.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1680.70	2329.70	3680.15	3741.20	4471.70	5861.65	5723.10	6559.10	8035.25
Delivered	1318.75	1643.85	2415.10	3335.15	3744.15	4499.75	5246.55	5809.10	6575.90
Delivered (%)	78.61	70.64	65.63	89.19	83.79	76.79	91.69	88.61	81.87
Delivered late	14.95	12.75	6.80	2.80	2.20	1.05	9.80	5.60	5.35
Late containers	15.05	13.35	6.852	8.1515	3.651	1.5	13.149	6.3525	13.8985
Late containers (%)	0.90	0.57	0.19	0.22	0.08	0.03	0.23	0.10	0.17
St. dev. of late containers	14.42	20.08	9.46	6.41	4.43	3.60	19.36	7.68	9.15
Capacity filled (%)	13.75	15.64	17.01	19.72	21.36	22.46	26.60	26.06	26.87
Average lateness	245.50	195.68	160.77	82.02	34.72	10.34	70.64	149.44	103.01
Relocations	453.40	553.10	677.80	832.40	916.85	977.20	1275.80	1149.55	1244.20
Cost	15054.85	16774.46	23906.53	29761.44	31808.26	35235.41	39337.63	40905.70	44380.37
St. dev of costs	2184.14	1961.22	3004.13	2540.15	2050.09	2497.06	3192.95	1662.33	1915.76

Table 17: RL agent 2 - uniform demand.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1688.15	2411.90	3759.10	3720.00	4394.40	5810.40	5697.30	6410.60	7768.85
Delivered	1395.00	1827.30	2500.80	3423.15	3808.60	4594.70	5407.20	5815.80	6555.40
Delivered (%)	82.64	75.69	66.64	92.07	86.74	79.16	94.96	90.74	84.43
Delivered late	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.55	50.35
Late containers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.55	50.35
Late containers (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.65
St. dev. of late containers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.97	96.33
Capacity filled	0.53	0.80	1.80	3.23	4.71	6.71	9.00	12.03	15.58
Average lateness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.37	69.70
Relocations	532.10	584.15	589.10	621.90	626.15	611.45	616.25	619.10	614.75
Cost	51979.27	56775.27	56872.01	56298.18	57067.64	56193.91	54283.55	54846.23	53787.73
St. dev. of cost	4664.06	2381.31	1419.17	1684.23	1081.90	638.11	1699.67	975.94	673.49

Table 18: Urgency heuristic - uniform demand.

No. of containers (NC)	1000			3000			5000		
Rate of arrival (λ^r)	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1755.05	2302.80	3696.90	3679.15	4413.30	5703.35	5700.60	6369.40	7654.70
Delivered	1359.55	1605.65	2244.85	3324.15	3664.80	4247.00	5298.30	5624.30	6091.80
Delivered (%)	77.54	69.83	60.83	90.40	83.10	74.47	92.98	88.32	79.63
Delivered late	0.55	0.00	5.70	13.50	28.45	78.50	90.60	164.10	183.90
Late containers	0.55	0.00	5.70	13.50	28.45	78.50	90.60	164.10	183.90
Late containers (%)	0.04	0.00	0.26	0.41	0.77	1.86	1.75	2.98	3.07
St. dev. of late containers	2.40	0.00	9.00	38.73	63.66	147.33	185.92	307.87	197.44
Capacity filled (%)	8.52	10.77	15.08	19.62	22.21	24.52	29.98	33.28	38.81
Average lateness	1.64	0.00	18.51	51.43	48.24	115.47	209.10	147.87	183.47
Relocations	372.25	402.00	434.70	514.45	543.25	597.55	631.45	671.65	670.30
Cost	27361.46	28134.59	30663.28	36765.94	36917.77	38784.26	41108.04	42243.68	42297.02
St. dev. of costs	2663.22	3560.01	2089.98	2823.50	3151.10	1824.06	2763.96	3359.51	2895.75

Table 19: Hybrid heuristic - uniform demand.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1711.25	2307.00	3744.35	3764.95	4376.80	5779.35	5555.85	6295.80	7649.10
Delivered	1394.70	1742.10	2541.85	3443.75	3775.15	4572.55	5243.25	5651.80	6460.10
Delivered (%)	81.66	75.70	67.92	91.51	86.36	79.18	94.39	89.79	84.49
Delivered late	11.10	1.00	14.65	21.05	14.15	54.90	47.35	162.15	76.70
Late containers	16.40	13.20	16.45	24.25	25.40	56.90	47.35	198.85	91.05
Late containers (%)	0.96	0.57	0.44	0.64	0.58	0.98	0.85	3.16	1.19
St. dev. of late containers	43.09	54.19	51.58	73.10	85.41	128.69	143.68	393.72	174.68
Capacity filled (%)	3.83	4.60	6.91	10.10	11.23	14.72	17.19	19.52	22.61
Average lateness	77.25	12.06	103.78	46.08	41.94	137.10	138.06	414.99	218.44
Relocations	2086.80	1964.55	1861.30	1742.80	1664.45	1617.70	1579.05	1470.00	1441.15
Cost	61622.19	61034.95	60362.77	59291.43	58926.76	58054.71	57467.44	55971.40	55067.86
St. dev. of costs	642.41	1969.94	541.97	821.26	776.37	950.34	772.57	2110.92	1931.78

Table 20: RL agent 1 - demand spike 1.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1693.10	2488.80	3728.10	3783.15	4449.00	5955.35	5693.30	6453.25	7878.95
Delivered	1307.70	1720.90	2386.90	3341.15	3721.65	4592.50	5319.80	5659.00	6493.35
Delivered (%)	77.32	69.17	63.95	88.36	83.73	77.14	93.45	87.74	82.45
Delivered late	34.80	15.80	8.10	7.30	5.55	6.55	15.45	19.40	60.65
Late containers	42.55	18.50	8.10	11.25	9.30	6.55	21.85	53.05	98.25
Late containers (%)	2.51	0.74	0.22	0.30	0.21	0.11	0.38	0.82	1.25
St. dev. of late containers	40.76	17.00	11.39	12.46	11.19	9.72	49.81	198.32	267.56
Capacity filled (%)	nan	17.12	18.42	22.94	23.58	25.41	27.91	28.76	30.16
Average lateness	349.67	383.15	126.67	89.32	105.81	89.68	209.89	136.11	258.40
Relocations	440.55	509.15	621.20	762.05	793.20	967.45	1058.80	1103.40	1174.60
Cost	13589.35	17586.27	22257.47	28569.90	29378.51	34178.60	38048.79	39544.90	41314.40
St. dev. of costs	1744.45	1915.94	3125.32	3159.68	1779.91	3362.22	2901.65	2546.98	2780.01

Table 21: RL agent 2 - demand spike 1.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1691.85	2451.35	3705.10	3699.55	4333.25	5690.15	5576.30	6240.15	7453.00
Delivered	1412.80	1797.60	2498.95	3398.20	3788.35	4496.80	5289.00	5651.90	6281.75
Delivered (%)	83.69	73.57	67.56	91.89	87.50	79.06	94.87	90.62	84.31
Delivered late	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.40
Late containers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.20
Late containers (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.36
St. dev. of late containers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.32
Capacity filled (%)	0.54	0.97	2.00	4.89	5.90	8.00	14.51	16.19	17.84
Average lateness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.07
Relocations	538.70	586.10	598.60	606.45	602.85	597.35	588.25	593.75	580.10
Cost	50759.10	55306.36	56836.37	55541.49	56695.63	55972.62	54308.27	54907.49	53585.64
St. dev. of costs	3410.72	2541.88	1373.58	1676.05	1193.54	752.21	1952.40	800.68	534.26

Table 22: Urgency heuristic - demand spike 1.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1683.00	2325.80	3760.05	3698.50	4412.40	5830.70	5591.25	6363.85	7681.50
Delivered	1327.25	1613.75	2223.10	3322.10	3658.50	4308.75	5215.45	5591.25	6229.15
Delivered (%)	78.91	69.40	59.21	89.88	82.95	73.91	93.29	87.92	81.14
Delivered late	0.55	0.20	6.60	21.30	40.85	49.20	52.35	34.45	125.00
Late containers	0.55	0.20	7.90	21.30	40.85	77.90	54.10	42.45	135.95
Late containers (%)	0.03	0.01	0.21	0.58	0.93	1.34	0.97	0.67	1.77
St. dev. of late containers	2.40	0.87	22.41	70.35	106.37	225.77	88.34	90.72	160.66
Capacity filled (%)	9.65	10.92	15.22	20.73	22.04	26.04	31.16	31.22	36.61
Average lateness	4.22	5.98	18.65	46.27	62.08	143.61	90.61	42.82	145.14
Relocations	357.00	403.40	424.05	508.65	534.65	560.10	565.35	579.15	591.05
Cost	25238.75	27279.01	30733.15	33655.81	35676.13	37370.66	38973.21	38444.26	39993.58
St. dev. of costs	2663.78	1798.24	2512.39	2304.00	2822.21	3116.08	3369.02	3028.06	2355.71

Table 23: Hybrid heuristic - demand spike 1.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1539.00	2086.10	3225.35	3579.40	4123.00	5308.35	5632.70	6204.55	7606.90
Delivered	1298.50	1600.15	2284.00	3341.95	3658.15	4285.90	5372.40	5724.35	6501.15
Delivered (%)	84.47	76.97	70.85	93.38	88.78	80.78	95.41	92.27	85.48
Delivered late	0.50	2.70	0.00	1.30	0.00	20.30	2.40	7.70	13.30
Late containers	2.55	14.65	10.75	2.10	0.95	28.80	2.40	7.70	25.20
Late containers (%)	0.17	0.70	0.33	0.06	0.02	0.54	0.04	0.12	0.33
St. dev. of late containers	9.09	31.32	46.86	6.50	4.14	58.09	6.24	17.69	48.19
Capacity filled (%)	3.43	4.17	6.13	9.12	10.53	12.75	16.66	17.92	20.68
Average lateness	1.95	51.23	0.00	4.19	0.00	152.77	60.12	79.47	53.70
Relocations	2102.30	2020.65	1876.50	1752.55	1698.05	1590.60	1571.30	1519.15	1441.10
Cost	61767.69	61161.06	60445.71	59881.21	59408.28	58396.67	57824.49	57267.43	56243.34
St. dev. of costs	758.15	1122.38	1171.17	524.27	639.42	699.86	535.94	378.03	735.59

Table 24: RL agent 1 - demand spike 2.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1611.60	2166.15	3224.75	3657.65	4190.45	5386.05	5635.30	6294.85	7299.05
Delivered	1237.20	1540.70	2111.95	3274.15	3584.05	4263.85	5320.40	5645.40	6281.90
Delivered (%)	77.13	71.13	65.63	89.57	85.66	79.23	94.43	89.70	86.13
Delivered late	25.90	17.00	18.85	6.80	8.35	3.95	7.85	3.10	4.45
Late containers	32.90	21.40	21.15	10.65	13.10	5.75	11.05	7.35	5.10
Late containers (%)	2.04	0.99	0.66	0.29	0.31	0.11	0.20	0.12	0.07
St. dev. of late containers	34.27	18.46	24.37	8.30	18.67	8.86	13.95	16.08	11.01
Capacity filled (%)	13.96	15.66	19.69	21.51	21.88	23.74	26.34	26.86	27.84
Average lateness	398.39	232.42	209.33	111.43	163.16	49.51	82.58	70.46	59.30
Relocations	413.35	481.05	548.30	778.50	860.60	928.40	1015.65	1067.55	1179.30
Cost	13788.81	15660.03	19502.05	27450.80	29740.71	33570.39	37534.39	39379.50	43171.42
St. dev. of costs	1969.63	2420.41	1926.30	2599.53	3187.36	1838.75	2724.55	2363.47	1697.82

Table 25: RL agent 2 - demand spike 2.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1590.00	2150.20	3203.05	3586.30	4108.45	5167.60	5599.10	6140.45	7141.80
Delivered	1352.25	1640.55	2301.30	3337.75	3646.10	4224.95	5377.35	5670.85	6177.20
Delivered (%)	85.11	76.51	71.86	93.11	88.77	81.81	96.04	92.37	86.55
Delivered late	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.60	6.40
Late containers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.60	6.40
Late containers (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.09
St. dev. of late containers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.77	27.90
Capacity filled (%)	0.54	0.92	2.25	3.21	4.57	7.08	9.75	10.95	15.58
Average lateness	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.45	1.86
Relocations	502.95	566.05	590.95	587.90	602.65	606.40	567.25	589.80	578.75
Cost	48062.17	54828.39	56906.07	55143.33	56999.96	56181.15	53754.81	54556.47	54036.37
St. dev. of costs	3433.07	2572.55	1471.80	1918.81	1507.41	673.94	1913.37	1062.88	469.00

Table 26: Urgency heuristic - demand spike 2.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1556.00	2067.80	3194.25	3578.50	4123.40	5261.20	5598.25	6105.35	7149.50
Delivered	1261.05	1485.65	2078.65	3238.40	3537.40	4146.45	5301.45	5448.80	6013.05
Delivered (%)	81.18	71.98	65.23	90.54	85.84	78.84	94.73	89.26	84.13
Delivered late	0.20	2.10	6.75	17.05	19.30	38.15	50.95	64.85	111.35
Late containers	0.20	2.10	6.75	25.75	19.30	41.65	52.50	78.60	133.05
Late containers (%)	0.01	0.10	0.21	0.72	0.47	0.79	0.94	1.29	1.86
St. dev. of late containers	0.87	8.08	14.56	98.36	47.05	57.61	150.65	167.68	222.61
Capacity filled (%)	9.25	10.47	14.55	18.96	20.70	24.15	29.55	29.86	34.57
Average lateness	0.17	3.75	24.43	12.00	25.59	102.56	84.08	120.27	210.61
Relocations	364.55	377.95	426.25	502.10	500.95	515.05	571.25	620.70	627.30
Cost	25224.42	26575.50	29870.40	34477.91	35151.40	36209.54	39066.36	40849.10	41231.45
St. dev. of costs	3123.45	2530.60	2442.59	3390.51	2144.15	2096.95	3463.38	2702.86	2980.45

Table 27: Hybrid heuristic - demand spike 2.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1704.15	2549.80	3798.30	3768.40	4554.05	5919.20	5759.50	6519.65	7953.20
Delivered	1416.15	1920.55	2625.95	3500.20	3928.25	4618.55	5430.30	5841.55	6329.00
Delivered (%)	83.30	75.40	69.17	92.94	86.32	78.04	94.27	89.65	79.56
Delivered late	0.00	0.80	0.00	0.25	2.30	31.05	103.35	80.10	185.15
Late containers	0.00	0.80	0.00	0.25	2.30	44.15	136.10	112.95	338.00
Late containers (%)	0.00	0.03	0.00	0.01	0.05	0.75	2.36	1.73	4.25
St. dev. of late containers	0.00	3.49	0.00	1.09	10.03	106.86	466.86	145.07	457.14
Capacity filled (%)	5.55	7.31	10.93	15.85	18.17	24.33	31.63	35.14	43.43
Average lateness	0.00	1.37	0.00	0.28	3.46	130.91	278.02	221.12	469.06
Relocations	1382.35	1306.20	1159.10	1067.45	1012.10	942.60	956.55	900.40	835.45
Cost	40811.71	40176.90	39370.36	38485.56	37835.21	36520.18	35574.63	34900.10	32764.25
St. dev. of costs	460.93	432.43	473.41	326.54	521.70	1260.97	1715.03	1192.63	2121.52

Table 28: RL agent 1 - fleet of 6 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1714.70	2450.55	3896.10	3756.20	4501.95	5864.15	5804.55	6514.80	7911.65
Delivered	1368.35	1766.85	2557.35	3412.75	3784.70	4491.55	5338.95	5678.20	6240.45
Delivered (%)	79.95	72.16	65.67	90.89	84.12	76.49	92.01	87.25	78.64
Delivered late	4.10	8.70	7.25	7.15	3.55	8.30	85.55	44.05	180.70
Late containers	4.10	8.70	7.25	7.15	10.30	34.45	140.15	144.30	434.60
Late containers (%)	0.24	0.36	0.19	0.19	0.23	0.59	2.41	2.21	5.49
St. dev of late containers	7.92	17.89	15.41	14.60	29.51	102.04	299.42	355.91	547.42
Capacity filled (%)	18.06	20.87	24.16	25.16	27.49	30.70	37.89	40.12	49.32
Average lateness	104.93	51.53	43.19	63.02	15.82	227.52	303.67	234.53	419.45
Relocations	424.15	531.05	629.70	729.55	788.65	836.20	822.55	826.80	875.15
Cost	13279.16	16391.39	20459.56	25586.29	26966.97	28682.61	29181.87	29937.21	30292.14
St. dev of costs	1659.69	1369.50	1433.58	1320.45	1437.53	1950.59	1179.64	1260.53	2281.44

Table 29: RL agent 2 - fleet of 6 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1692.60	2406.65	3796.30	3710.55	4394.65	5800.35	5695.35	6424.15	7745.00
Delivered	1406.25	1809.80	2498.35	3432.70	3768.55	4416.20	5391.60	5725.45	6069.60
Delivered (%)	83.33	75.43	65.80	92.53	85.78	76.19	94.68	89.15	78.43
Delivered late	0.00	0.00	0.00	0.00	18.80	154.40	305.20	477.35	689.65
Late containers	0.00	0.00	0.00	0.00	18.80	165.35	305.60	499.80	877.15
Late containers (%)	0.00	0.00	0.00	0.00	0.43	2.85	5.37	7.78	11.33
St. dev. of late containers	0.00	0.00	0.00	0.00	54.47	137.11	248.56	258.17	470.24
Capacity filled (%)	1.23	2.09	4.57	9.25	11.22	18.09	24.90	28.75	37.43
Average lateness	0.00	0.00	0.00	0.00	24.02	326.44	504.10	857.67	796.23
Relocations	356.80	385.65	373.35	385.60	385.60	358.95	382.20	382.20	358.50
Cost	34410.16	37662.23	36178.96	36634.93	36175.70	34256.05	35219.19	34297.86	32508.18
St. dev. of costs	2359.18	730.92	691.19	846.31	470.71	463.97	492.44	563.70	489.22

Table 30: Urgency heuristic - fleet of 6 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1677.05	2349.95	3708.85	3732.90	4333.75	5635.15	5755.55	6237.60	7631.25
Delivered	1279.00	1606.20	2169.30	3342.80	3603.05	4088.30	5131.55	5271.00	5826.65
Delivered (%)	76.63	68.41	58.62	89.57	83.25	72.59	89.22	84.56	76.42
Delivered late	0.00	0.00	12.10	21.65	78.50	113.70	460.35	479.15	1055.50
Late containers	0.00	0.00	24.15	29.50	89.20	157.20	603.25	599.50	1194.70
Late containers (%)	0.00	0.00	0.65	0.79	2.06	2.79	10.48	9.61	15.66
St. dev. of late containers	0.00	0.00	64.47	61.50	182.12	270.03	556.39	524.88	651.50
Capacity filled (%)	12.97	15.81	20.94	28.25	32.01	37.97	47.84	49.21	59.12
Average lateness	0.00	0.00	36.56	62.91	106.44	137.77	604.91	381.77	382.76
Relocations	261.00	282.75	299.50	362.30	374.65	377.55	505.35	462.70	426.30
Cost	19139.39	20956.02	21886.62	25976.47	26444.83	26697.98	30748.02	29733.33	29056.29
St. dev. of costs	1254.47	1552.90	1602.04	1821.73	1826.53	1293.07	1989.83	1357.26	1062.01

Table 31: Hybrid heuristic - fleet of 6 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1762.70	2379.25	3784.45	3779.85	4499.95	5815.40	5812.55	6545.35	7922.90
Delivered	1422.40	1794.70	2619.85	3482.55	3869.45	4658.10	5482.25	5828.65	6632.50
Delivered (%)	80.85	75.41	69.24	92.15	86.00	80.10	94.34	89.05	83.78
Delivered late	0.00	0.00	0.00	0.00	0.00	1.15	2.55	10.45	41.50
Late containers	0.00	0.00	0.00	0.00	0.00	1.15	9.10	152.75	67.15
Late containers (%)	0.00	0.00	0.00	0.00	0.00	0.02	0.16	2.33	0.85
St. dev. of late containers	0.00	0.00	0.00	0.00	0.00	5.01	28.83	230.82	136.00
Capacity filled (%)	4.83	6.37	9.96	12.51	14.78	20.12	24.38	29.03	32.54
Average lateness	0.00	0.00	0.00	0.00	0.00	3.75	34.06	170.28	238.86
Relocations	1644.80	1539.65	1401.15	1300.70	1243.75	1141.60	1129.50	1094.40	1034.50
Cost	47815.66	47174.99	46230.15	45634.54	45020.94	44078.66	43544.83	41726.24	41260.52
St. dev. of costs	336.37	481.39	522.07	368.43	597.76	548.58	722.53	2156.48	1087.55

Table 32: RL agent 1 - fleet of 7 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1709.90	2389.75	3835.30	3733.65	4518.70	5904.15	5814.20	6516.80	7853.90
Delivered	1336.50	1692.20	2510.75	3358.65	3794.80	4564.70	5417.00	5685.70	6256.85
Delivered (%)	78.27	70.99	65.55	89.97	84.07	77.35	93.17	87.24	79.68
Delivered late	9.45	15.25	5.40	9.85	3.85	28.60	16.15	3.25	127.75
Late containers	16.35	15.75	5.40	26.35	4.65	34.05	28.30	92.95	240.55
Late containers (%)	0.96	0.66	0.14	0.71	0.10	0.58	0.49	1.43	3.06
St. dev. of late containers	14.28	17.95	9.42	96.12	8.63	102.04	52.47	378.25	434.32
Capacity filled (%)	16.96	18.56	21.26	25.57	25.98	28.78	33.00	35.04	40.52
Average lateness	300.03	178.96	96.50	18.17	108.07	185.06	117.14	53.07	324.07
Relocations	484.80	520.15	650.10	832.60	842.55	904.75	950.30	983.25	974.40
Cost	13328.97	16734.95	21562.53	27014.74	28817.67	32200.69	33638.89	34213.31	34946.15
St. dev. of costs	1171.12	1465.64	1562.91	2150.37	1898.92	1619.96	1423.53	1094.16	2815.09

Table 33: RL agent 2 - fleet of 7 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1774.50	2371.40	3831.55	3692.60	4366.20	5724.10	5687.65	6505.20	7791.85
Delivered	1419.40	1743.80	2540.70	3401.60	3790.00	4467.85	5390.25	5802.50	6345.50
Delivered (%)	80.14	73.62	66.33	92.18	86.91	78.08	94.77	89.26	81.48
Delivered late	0.00	0.00	0.00	0.00	0.00	18.50	69.75	200.85	325.50
Late containers	0.00	0.00	0.00	0.00	0.00	18.50	69.75	200.85	349.60
Late containers (%)	0.00	0.00	0.00	0.00	0.00	0.32	1.23	3.09	4.49
St. dev. of late containers	0.00	0.00	0.00	0.00	0.00	43.67	112.56	155.94	168.49
Capacity filled (%)	0.81	1.26	3.28	6.33	7.72	13.00	17.78	21.89	27.97
Average lateness	0.00	0.00	0.00	0.00	0.00	26.57	149.65	419.69	517.17
Relocations	415.05	454.65	443.90	458.15	461.50	443.25	445.05	443.60	432.10
Cost	40530.25	43668.90	42798.77	42733.94	43248.60	41655.65	41907.06	41347.40	39493.55
St. dev. of costs	2988.07	1476.28	816.20	1460.59	746.07	539.84	1195.22	631.04	390.24

Table 34: Urgency heuristic - fleet of 7 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1674.95	2362.10	3837.70	3691.75	4317.20	5819.30	5652.15	6367.70	7688.75
Delivered	1302.50	1630.95	2300.55	3310.45	3573.60	4283.10	5182.80	5627.35	6002.45
Delivered (%)	77.99	69.11	59.86	89.72	82.82	73.65	91.72	88.40	78.16
Delivered late	0.20	2.40	22.15	47.45	14.60	71.20	186.15	125.25	339.90
Late containers	0.20	2.40	30.65	47.60	14.60	92.85	257.05	145.60	472.20
Late containers (%)	0.01	0.10	0.80	1.29	0.34	1.60	4.55	2.29	6.14
St. dev. of late containers	0.87	6.51	71.24	112.46	45.25	166.74	297.76	277.92	447.63
Capacity filled (%)	10.96	13.25	19.59	25.90	26.66	32.94	40.06	40.31	47.56
Average lateness	1.58	4.34	51.05	85.70	25.37	65.61	342.12	150.99	307.05
Relocations	296.55	313.35	353.75	411.95	401.25	436.15	547.90	481.15	516.60
Cost	21745.03	22841.04	24646.37	28928.31	29240.52	30394.73	33709.28	33169.79	33868.29
St. dev. of costs	2218.38	2373.14	2158.63	2395.56	1775.39	1407.18	3160.18	1891.33	1826.81

Table 35: Hybrid heuristic - fleet of 7 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1707.80	2391.05	3841.15	3727.85	4410.60	5919.70	5766.55	6518.20	7963.30
Delivered	1410.40	1785.15	2629.75	3451.00	3828.30	4663.10	5448.30	5930.85	6681.15
Delivered (%)	82.62	74.84	68.46	92.60	86.89	78.79	94.49	91.04	83.93
Delivered late	0.00	0.00	0.00	0.00	0.55	0.30	2.30	0.60	26.35
Late containers	0.00	0.00	0.00	0.00	1.75	0.30	4.90	0.60	30.85
Late containers (%)	0.00	0.00	0.00	0.00	0.04	0.01	0.08	0.01	0.39
St. dev. of late containers	0.00	0.00	0.00	0.00	5.64	1.10	11.91	2.20	70.70
Capacity filled (%)	4.02	5.12	7.68	11.10	12.77	15.74	20.27	20.86	25.77
Average lateness	19.29	0.00	0.00	0.00	22.85	27.22	143.84	44.93	133.36
Relocations	1856.60	1788.15	1639.85	1537.05	1463.80	1375.00	1330.80	1315.25	1230.85
Cost	54605.42	54482.09	53378.81	52852.04	51880.69	51338.80	50348.56	50140.01	48858.26
St. dev. of costs	476.79	309.09	528.58	500.63	1590.09	556.59	2476.05	336.22	923.08

Table 36: RL agent 1 - fleet of 8 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1693.30	2395.05	3883.50	3707.40	4451.70	5889.85	5729.35	6526.65	7935.80
Delivered	1321.25	1689.00	2579.70	3299.95	3739.15	4565.85	5352.10	5806.60	6587.80
Delivered (%)	78.35	70.48	66.33	89.06	84.00	77.55	93.43	89.03	83.03
Delivered late	14.75	9.80	4.70	2.15	3.60	1.45	14.50	10.45	23.15
Late containers	17.05	16.55	4.80	4.85	6.05	2.45	16.65	10.95	23.35
Late containers (%)	1.01	0.69	0.12	0.13	0.14	0.04	0.29	0.17	0.29
St. dev of late containers	17.78	19.78	5.68	7.90	13.21	5.10	18.05	12.35	45.58
Capacity filled (%)	16.20	17.99	20.88	22.11	23.85	24.63	28.20	29.73	32.04
Average lateness	263.28	213.55	168.55	50.11	95.56	18.13	166.74	139.00	161.23
Relocations	450.20	492.90	627.80	774.70	801.25	938.75	1000.55	998.25	1078.85
Cost	14144.49	17026.24	21480.01	28510.51	28271.65	33401.63	35966.37	37256.65	39753.98
St. dev of costs	1342.76	1620.50	2129.92	1887.32	2002.23	1613.76	1941.32	1769.73	1699.19

Table 37: RL agent 2 - fleet of 8 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1688.95	2331.70	3805.85	3736.70	4383.60	5777.15	5699.00	6333.45	7757.25
Delivered	1392.20	1739.20	2557.90	3423.60	3802.65	4581.65	5400.35	5720.70	6530.00
Delivered (%)	82.53	74.72	67.25	91.66	86.79	79.32	94.78	90.38	84.21
Delivered late	0.00	0.00	0.00	0.00	0.00	0.00	0.50	36.30	180.35
Late containers	0.00	0.00	0.00	0.00	0.00	0.60	0.50	36.30	189.80
Late containers (%)	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.57	2.45
St. dev. of late containers	0.00	0.00	0.00	0.00	0.00	2.62	2.18	92.47	166.67
Capacity filled (%)	0.54	0.77	2.73	4.63	5.46	9.10	13.22	14.57	19.59
Average lateness	0.00	0.00	0.00	0.00	0.00	0.00	5.09	92.50	300.91
Relocations	448.85	513.85	516.85	525.50	532.45	514.20	503.80	512.00	511.45
Cost	44004.34	49112.76	49885.14	49103.53	49975.15	48803.05	47460.10	48293.05	46942.68
St. dev. of costs	3534.45	1663.60	1259.54	1794.49	1671.32	391.24	1487.25	687.58	501.87

Table 38: Urgency heuristic - fleet of 8 ships.

No. of containers	1000			3000			5000		
Rate of arrival	0.5	1	2	0.5	1	2	0.5	1	2
Total containers	1709.50	2413.95	3713.25	3691.30	4335.65	5734.30	5679.65	6364.25	7708.80
Delivered	1337.70	1657.70	2257.40	3297.10	3656.45	4203.55	5240.85	5563.05	6178.30
Delivered (%)	78.38	68.77	60.82	89.36	84.39	73.31	92.37	87.47	80.16
Delivered late	0.00	7.45	0.00	54.95	88.50	73.45	172.10	111.65	243.70
Late containers	0.00	7.45	0.00	66.15	89.95	98.15	215.10	154.00	354.45
Late containers (%)	0.00	0.31	0.00	1.79	2.07	1.71	3.79	2.42	4.60
St. dev. of late containers	0.00	15.90	0.00	130.62	180.22	154.91	359.51	287.81	420.54
Capacity filled (%)	8.66	12.10	16.42	21.61	25.60	27.74	33.67	36.12	38.90
Average lateness	0.00	9.55	0.00	172.64	178.00	150.08	208.23	225.84	323.70
Relocations	334.70	354.80	385.05	523.95	493.15	530.75	574.00	576.45	601.35
Cost	23308.51	25332.28	27540.74	32570.13	33060.07	34524.43	36578.22	36848.48	38187.02
St. dev. of costs	1639.10	1823.36	2301.02	4767.94	2627.73	2356.71	3821.17	3270.82	2654.86

Table 39: Hybrid heuristic - fleet of 8 ships.