Assignment 3

Call_7_Vehicle_3

✅	Average objective	Best objective	Improvement (%)	Running time
Random	1523967.2	1457231.0	55.06%	0.85s
Local Search	1286266.5	1134176.0	65.02%	16.55s
Simulated annnealing	1134176.0	1134176.0	65.02%	13.39s

Best solution: [4, 4, 7, 7, 0, 2, 2, 0, 1, 5, 5, 3, 3, 1, 0, 6, 6]

Call_18_Vehicle_5

✅	Average objective	Best objective	Improvement (%)	Running time
Random	6997886.2	5981431.0	33.24%	1.76s
Local Search	3441086.2	2773808.0	69.04%	1.12s
Simulated annnealing	2412233.4	2374420.0	73.5%	28.05s

Best solution: [4, 4, 15, 15, 11, 11, 16, 16, 0, 6, 6, 5, 18, 5, 14, 17, 17, 14, 18, 0, 9, 8, 8, 9, 13, 13, 0, 7, 7, 3, 3, 10, 1, 10, 1, 0, 12, 12, 0, 2, 2]

Call_35_Vehicle_7

✅	Average objective	Best objective	Improvement (%)	Running time
Random	18387821.0	18387821.0	0.0%	1.33s
Local Search	8120836.2	7162000.0	61.05%	3.05s
Simulated annealing	5682199.6	5366140.0	70.82%	47.25s

Best solution: [34, 30, 34, 30, 27, 27, 22, 22, 25, 25, 0, 15, 15, 11, 11, 7, 7, 32, 32, 0, 19, 19, 24, 24, 13, 13, 28, 28, 31, 31, 0, 4, 4, 23, 23, 8, 8, 33, 33, 20, 20, 0, 9, 14, 17, 35, 14, 17, 9, 21, 35, 26, 21, 26, 0, 16, 16, 1, 3, 3, 18, 18, 1, 5, 5, 2, 29, 29, 2, 0, 12, 12, 10, 10, 0, 6, 6]

Call_80_Vehicle_20

✅	Average objective	Best objective	Improvement (%)	Running time
Random	46770347.0	46770347.0	0.0%	1.38s
Local Search	19335743.2	17844451.0	61.85%	11.75s
Simulated annealing	12798036.3	12077826.0	74.18%	45.23s

Best solution: [18, 18, 33, 33, 0, 54, 63, 54, 63, 0, 60, 60, 64, 64, 5, 5, 77, 77, 0, 70, 21, 70, 67, 21, 72, 67, 7, 7, 10, 72, 10, 0, 71, 71, 49, 49, 0, 8, 8, 48, 17, 17, 48, 73, 50, 73, 14, 14, 50, 0, 41, 41, 4, 4, 35, 12, 12, 35, 16, 16, 0, 22, 61, 61, 22, 26, 26, 58, 58, 0, 40, 29, 40, 29, 65, 65, 27, 27, 0, 15, 15, 68, 68, 55, 46, 55, 46, 28, 28, 0, 1, 34, 34, 44, 44, 1, 0, 23, 23, 20, 20, 0, 25, 51, 25, 43, 51, 43, 0, 57, 79, 57, 75, 79, 75, 0, 66, 9, 9, 66, 0, 32, 62, 62, 45, 45, 32, 19, 19, 47, 47, 6, 6, 0, 53, 30, 30, 53, 76, 76, 2, 2, 24, 24, 0, 13, 13, 37, 31, 36, 36, 37, 31, 0, 39, 39, 59, 59, 78, 69, 69, 78, 52, 56, 56, 52, 0, 11, 11, 74, 42, 42, 3, 3, 74, 80, 80, 0, 38, 38]

Call_130_Vehicle_40

✅	Average objective	Best objective	Improvement (%)	Running time
Random	76627567.0	76627567.0	0.0%	1.94s
Local Search	30419769.1	27328673.0	64.34%	28.03s
Simulated annealing	20310804.0	19701086.0	74.29%	50.84s

Best solution: [23, 23, 120, 120, 20, 20, 0, 27, 27, 97, 97, 0, 42, 42, 34, 34, 83, 83, 39, 39, 0, 5, 5, 99, 61, 61, 99, 0, 124, 109, 124, 37, 109, 46, 36, 46, 37, 36, 0, 16, 16, 41, 92, 41, 92, 28, 28, 14, 14, 0, 80, 80, 25, 25, 59, 68, 70, 68, 70, 59, 0, 44, 113, 113, 44, 0, 123, 74, 123, 74, 10, 53, 30, 10, 53, 30, 0, 3, 3, 88, 88, 117, 117, 0, 66, 66, 0, 103, 103, 50, 1, 40, 40, 50, 1, 0, 11, 11, 62, 62, 18, 18, 35, 127, 127, 7, 7, 35, 0, 105, 105, 111, 79, 79, 111, 0, 114, 58, 58, 114, 0, 84, 95, 84, 95, 45, 17, 17, 45, 56, 56, 77, 77, 0, 98, 98, 107, 107, 26, 26, 0, 32, 32, 29, 82, 82, 29, 0, 96, 96, 55, 55, 118, 118, 0, 54, 54, 125, 125, 0, 115, 126, 126, 115, 0, 129, 129, 9, 51, 9, 51, 0, 72, 102, 102, 130, 72, 130, 110, 110, 57, 57, 0, 19, 19, 128, 128, 0, 69, 87, 69, 87, 0, 33, 33, 47, 47, 76, 76, 0, 2, 2, 13, 101, 13, 101, 0, 6, 6, 52, 122, 91, 91, 122, 52, 0, 85, 85, 89, 64, 64, 89, 0, 24, 24, 0, 119, 119, 116, 116, 71, 71, 0, 15, 121, 15, 121, 67, 22, 67, 22, 0, 93, 93, 65, 65, 43, 43, 0, 21, 106, 90, 90, 21, 106, 0, 60, 60, 108, 108, 78, 78, 0, 73, 112, 112, 73, 0, 8, 8, 81, 94, 12, 94, 81, 12, 0, 38, 38, 4, 4, 104, 48, 48, 104, 0, 100, 100, 31, 63, 31, 63, 0, 75, 75, 0, 49, 49, 86, 86]

Call_300_Vehicle_90

✅	Average	Best	Improvement	Running

Call_300_Vehicle_90				
	objective	objective	(%)	time
Random	170784643.0	170784643.0	0.0%	2.59s
Local Search	70229470.2	65942284.0	61.39%	114.29s
Simulated annealing	47249719.0	46460334.0	72.8%	93.64s

Best solution: [250, 194, 250, 194, 11, 11, 0, 96, 61, 61, 96, 53, 80, 80, 34, 53, 34, 18, 18, 0, 83, 83, 189, 189, 0, 235, 235, 12, 12, 0, 136, 136, 236, 90, 90, 236, 0, 152, 152, 172, 172, 253, 253, 0, 121, 121, 95, 294, 95, 294, 0, 72, 72, 0, 271, 271, 74, 74, 0, 36, 171, 171, 36, 246, 246, 51, 84, 51, 84, 0, 126, 126, 283, 283, 0, 155, 37, 155, 49, 49, 37, 0, 41, 41, 0, 249, 249, 108, 108, 139, 139, 0, 263, 263, 92, 92, 0, 25, 25, 23, 23, 9, 297, 9, 297, 130, 130, 0, 293, 293, 165, 165, 0, 30, 30, 129, 129, 0, 65, 300, 300, 65, 198, 198, 0, 48, 284, 48, 284, 262, 262, 231, 231, 0, 259, 259, 0, 7, 7, 55, 55, 0, 279, 279, 199, 91, 91, 199, 0, 68, 265, 68, 265, 141, 148, 141, 148, 0, 195, 195, 0, 245, 245, 0, 133, 133, 111, 266, 266, 111, 0, 45, 63, 45, 63, 0, 208, 208, 219, 127, 127, 191, 191, 219, 0, 167, 167, 27, 27, 0, 134, 134, 114, 77, 114, 77, 184, 101, 187, 101, 184, 187, 0, 218, 218, 204, 204, 112, 112, 0, 270, 277, 109, 109, 270, 277, 115, 292, 115, 292, 0, 276, 276, 47, 47, 258, 258, 0, 224, 151, 151, 224, 0, 35, 215, 123, 35, 123, 215, 145, 145, 153, 153, 97, 97, 0, 180, 180, 161, 161, 0, 88, 88, 132, 132, 0, 67, 67, 188, 188, 16, 16, 156, 156, 0, 54, 54, 62, 62, 42, 42, 21, 186, 186, 21, 0, 158, 1, 158, 1, 52, 52, 59, 59, 296, 296, 0, 217, 217, 288, 291, 220, 291, 275, 275, 220, 288, 0, 264, 278, 264, 185, 278, 79, 255, 185, 79, 255, 0, 179, 222, 222, 179, 228, 14, 14, 228, 0, 233, 233, 202, 202, 20, 20, 0, 32, 70, 32, 70, 0, 19, 19, 81, 3, 3, 81, 0, 211, 69, 69, 203, 211, 226, 73, 226, 50, 73, 203, 17, 17, 50, 0, 287, 287, 100, 100, 8, 8, 0, 105, 295, 295, 164, 105, 164, 0, 138, 138, 285, 285, 56, 56, 117, 117, 0, 183, 227, 183, 60, 227, 60, 102, 102, 0, 247, 247, 298, 298, 0, 274, 274, 119, 119, 46, 46, 197, 197, 0, 232, 150, 150, 232, 131, 131, 170, 170, 0, 272, 286, 286, 272, 4, 4, 0, 206, 210, 206, 290, 210, 290, 0, 257, 257, 177, 177, 0, 248, 241, 248, 207, 144, 207, 144, 241, 5, 5, 166, 166, 106, 106, 0, 192, 192, 22, 22, 0, 281, 281, 33, 33, 0, 26, 118, 118, 89, 89, 26, 0, 168, 168, 230, 230, 93, 93, 0, 260, 260, 205, 205, 0, 299, 225, 299, 225, 243, 243, 160, 209, 209, 140, 140, 160, 0, 201, 223, 201, 223, 0, 273, 269, 269, 273, 229, 229, 0, 238, 40, 40, 238, 0, 178, 254, 178, 254, 128, 122, 122, 128, 0, 94, 173, 94, 173, 0, 86, 86, 44, 6, 44, 6, 0, 78, 78, 237, 176, 237, 176, 0, 261, 234, 261, 182, 234, 267, 267, 182, 0, 169, 98, 98, 169, 196, 104, 196, 104, 0, 174, 174, 125, 85, 125, 85, 0, 240, 212, 181, 212, 181, 240, 0, 15, 15, 147, 147, 28, 163, 28, 2, 163, 2, 13, 13, 0, 116, 116, 216, 216, 175, 175, 0, 43, 43, 0, 280, 39, 280, 39, 38, 38, 252, 252, 0, 10, 10, 103, 103, 0, 214, 239, 214, 239, 0, 143, 200, 200, 143, 75, 157, 157, 75, 0, 213, 256, 256, 154, 154, 213, 0, 137, 137, 149, 149, 251, 113, 113, 251, 0, 76, 76, 124, 282, 124, 282, 190, 190, 0, 29, 244, 29, 244, 221, 120, 120, 221, 0, 110, 110, 64, 58, 58, 64, 0, 24, 24, 99, 107, 107, 99, 0, 82, 135, 135, 82, 268, 71, 268, 71, 289, 146, 146, 289, 0, 31, 31, 57, 57, 66, 66, 87, 87, 142, 142, 159, 159, 162, 162, 193, 193, 242, 242]

Thoughts

After looking at my results and comparing them with Eirik Bakke's results, it seems that my algorithm is good on the smaller problems, but is struggling to get good results the bigger the problem is, There

might be some over optimization for broad searching in my implementation.
Also looking at my solutions, the outsourcing vessel, takes very few packages, so i think the improvments are in the optimization inside each vessel.