**[INF-295] Inteligencia Artificial
Presentación Proyecto**

Green Vehicle Routing Problem (GVRP)

Lucio Fondón - 201773610-0

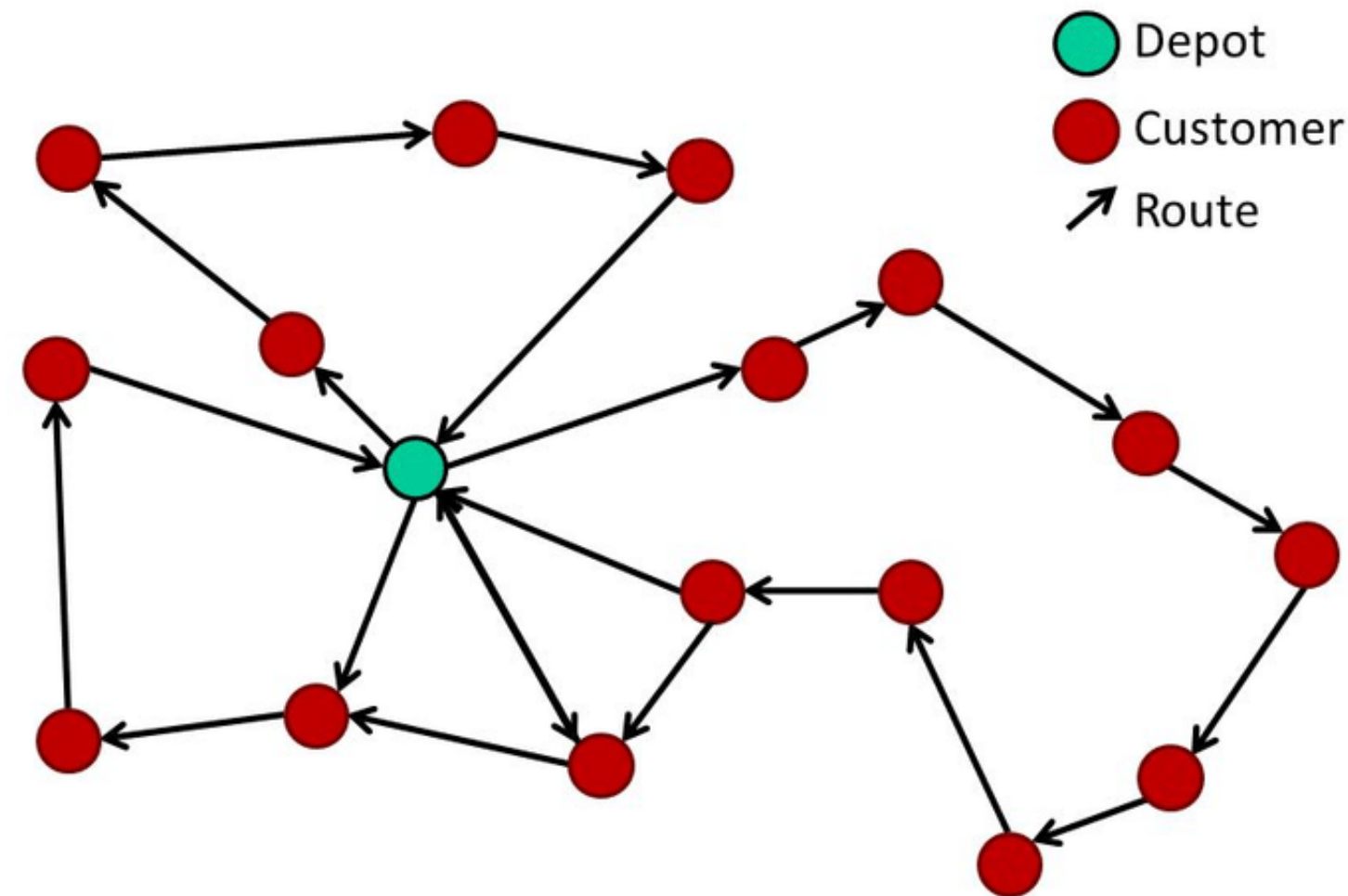# ÍNDICE

PROBLEMA: VRP

Los tipos de problema de VRP (Vehicle Routing Problem) buscan encontrar la mejor ruta para una cierta flota de vehículos que realizan entregas a clientes predispuestos en una zona geográfica en particular
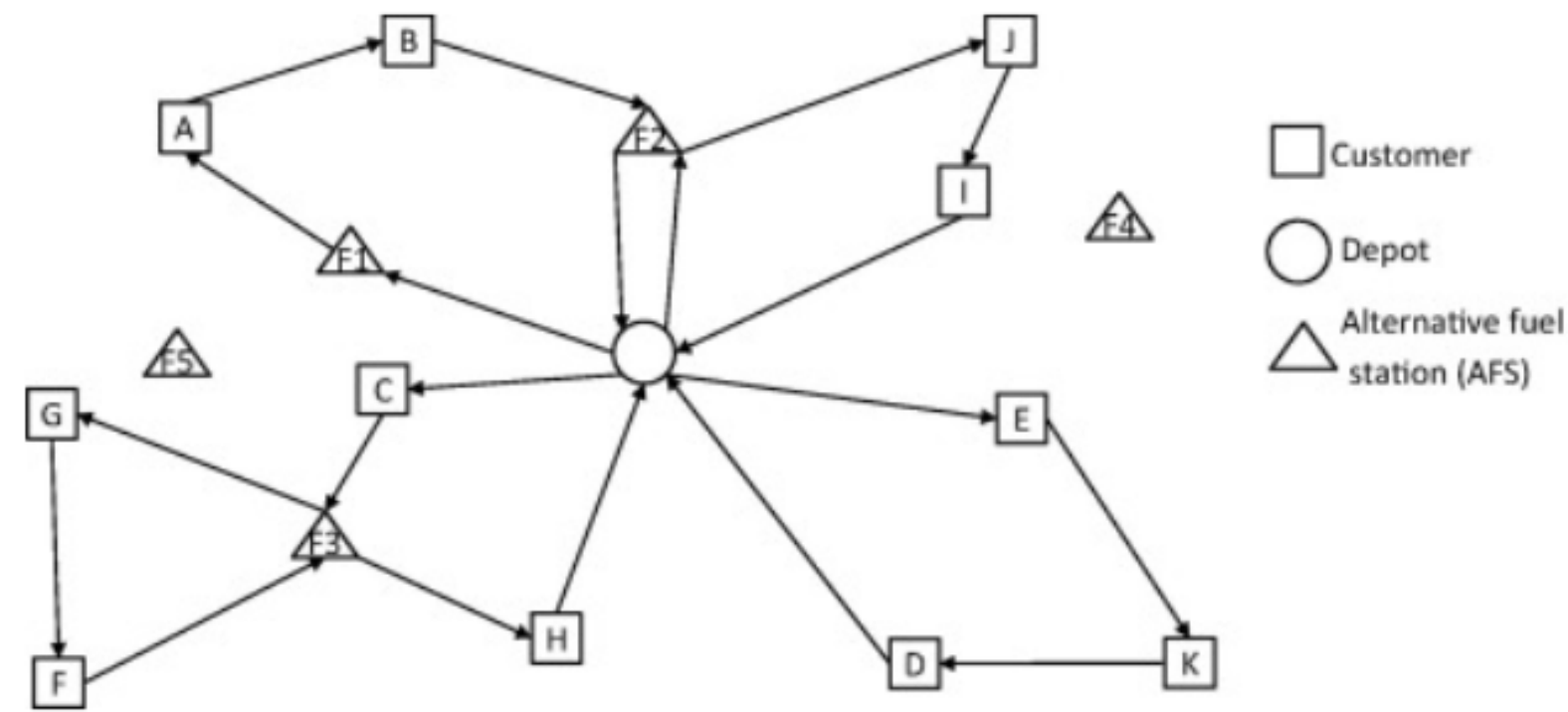
PROBLEMA: GVRP

Problema: Componentes

CLIENTES

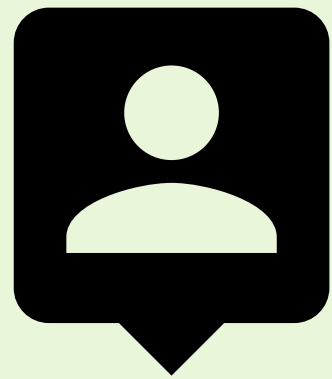ESTACIONES

VEHÍCULOS
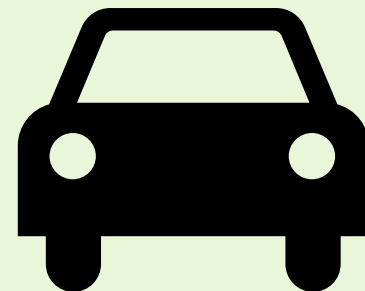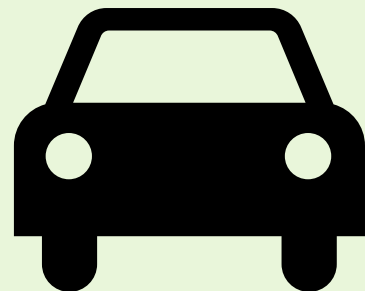
DEPÓSITO

Problema: Restricciones

PROPUESTA: REPRESENTACIÓN
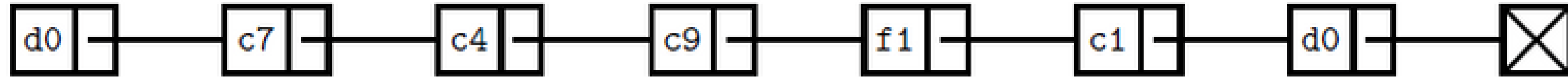
La lista enlazada representa los órdenes de visita de cada nodo

PROPUESTA: ALGORITMOS

Input

Greedy

Output Greedy

Simullated Annealing

Output final
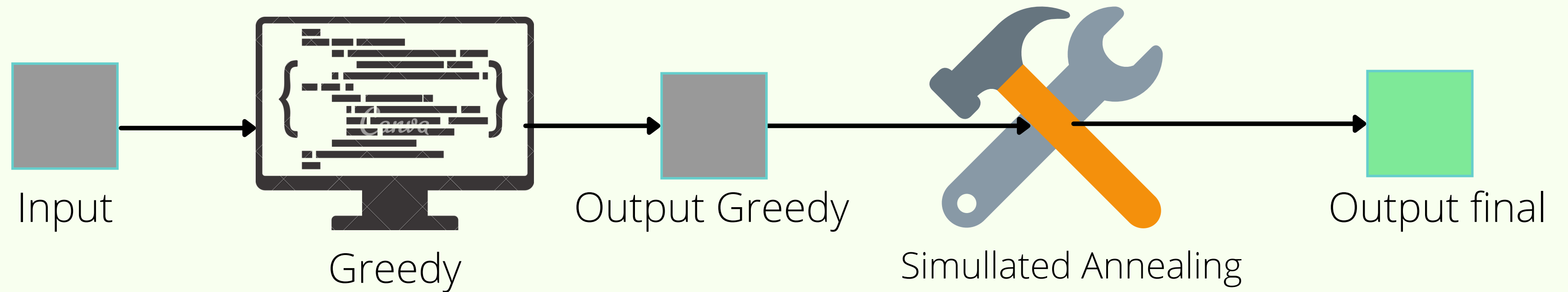
PROPUESTA: ALGORITMOS

Greedy

- Generará una solución inicial para una instancia
- Visitará siempre a los nodos más cercanos entre sí

Simullated Annealing

- Intentará mejorar las soluciones provistas por greedy
- Realizará movimientos entre nodos consecutivos para ver si mejorar la solucion inicial
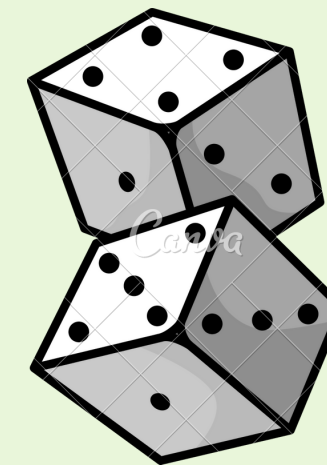
PROPUESTA: VERIFICACIÓN DE RESTRICCIONES

Cliente

Cliente

Depósito

Estación

Cliente
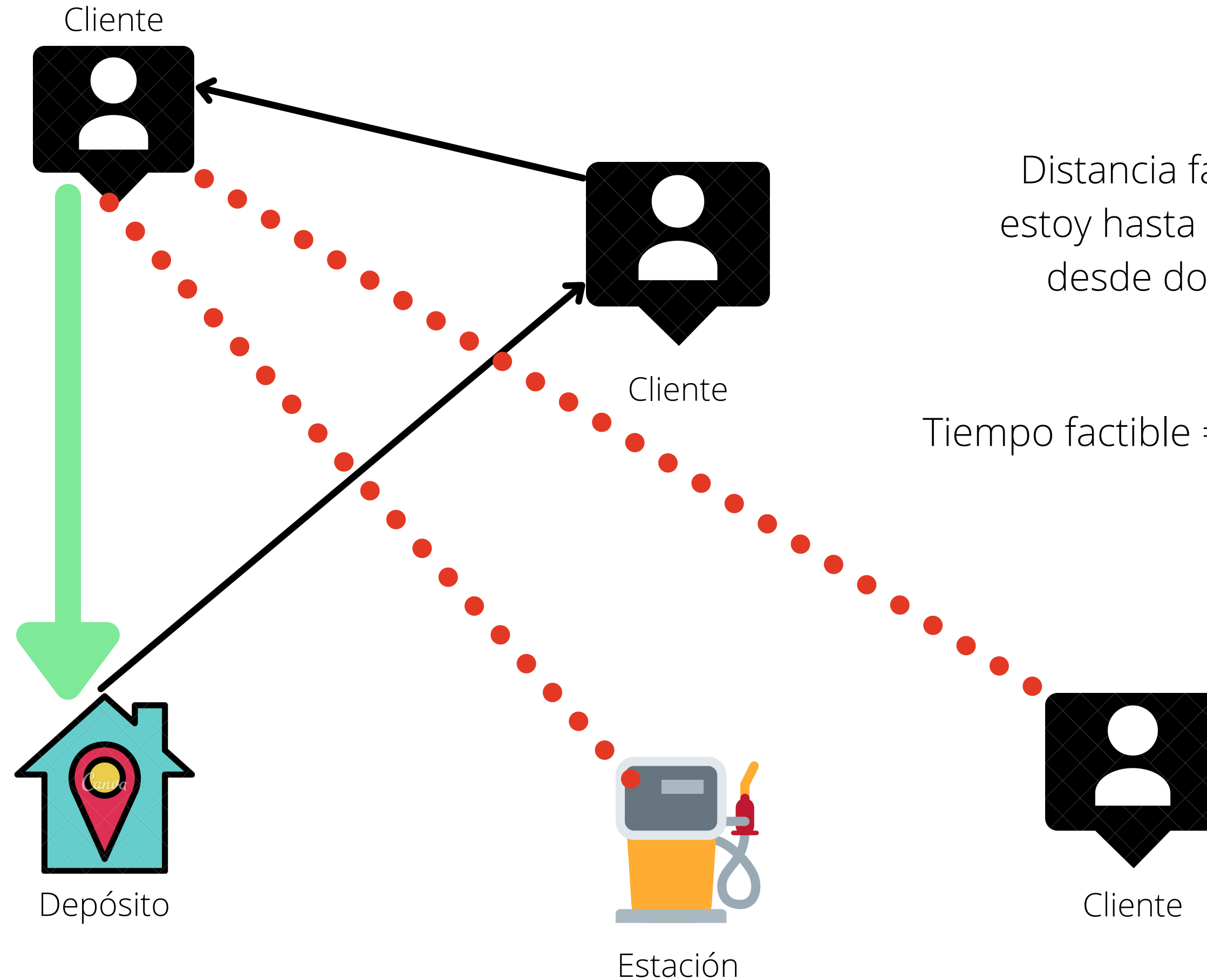
Distancia factible: Distancia desde donde estoy hasta donde quiero visitar + distancia desde donde quiero visitar a depósito

Tiempo factible = Distancia factible/velocidad del vehículo

PROPUESTA: MOVIMIENTOS
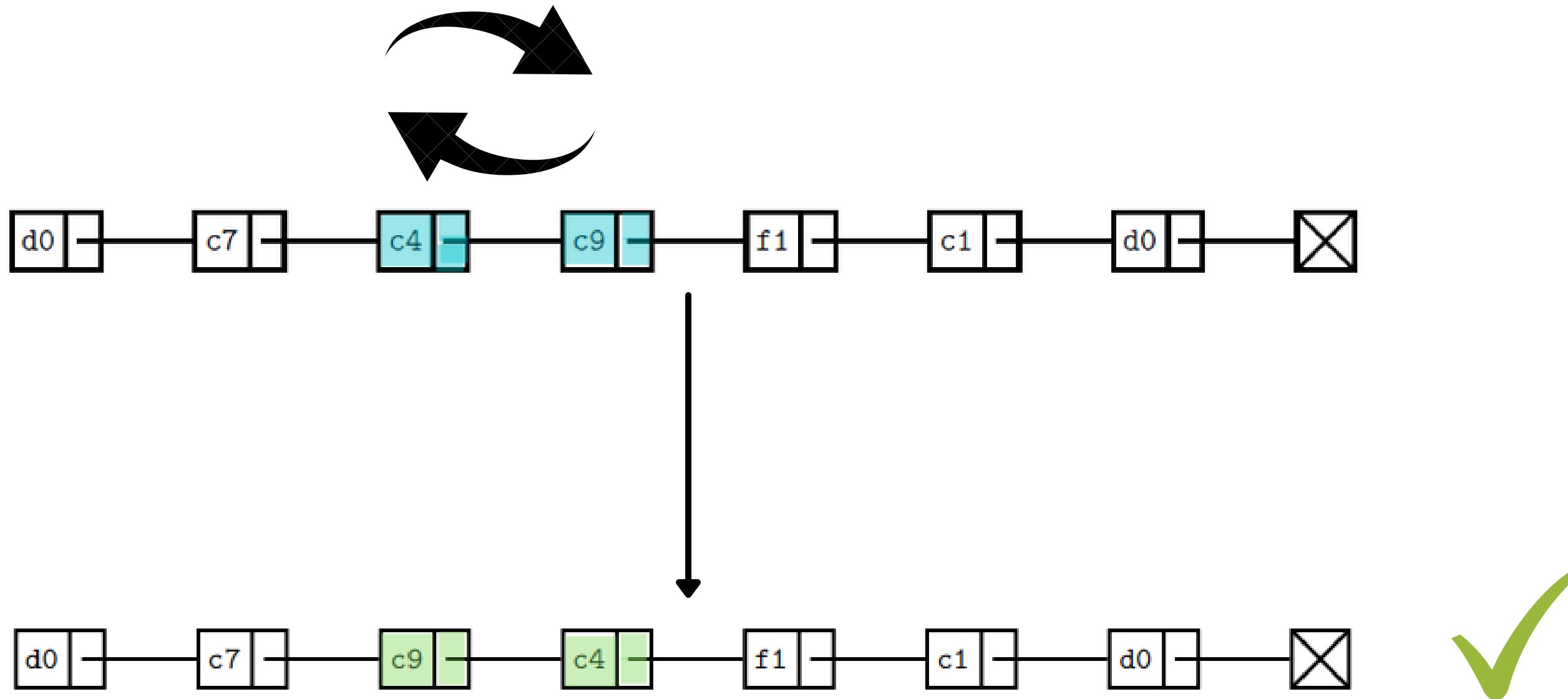
EXPERIMENTOS

- Se experimentará con las famosas instancias AB provenientes del paper *"An Exact Algorithm for the Green Vehicle Routing Problem"*

- Estas instancias nos entregan la información suficiente para conocer las posiciones geográficas de cada nodo, para así poder calcular sus distancias entre ellos

- Se experimentará y mostrarán resultados de las instancias:
    a. AB101
    b. AB103
    c. AB108
    d. AB117
    e. AB201

EXPERIMENTOS: RESULTADOS

AB101

Ruta	Distancia	Tiempo
d0-c37-c8-c9-c32-f7-c12-d0	280.981.161	584
d0-f16-c6-c18-d0	300.000.000	442
d0-c30-d0	233.823.555	380
d0-c41-d0	236.184.552	384
d0-c19-d0	245.342.924	398
d0-c15-d0	283.193.913	454
d0-c5-d0	286.682.035	460
d0-c4-d0	289.816.476	464
d0-c46-d0	298.636.110	476
d0-c28-d0	299.440.924	478
d0-f8-c50-d0	308.449.428	506
d0-f8-c10-d0	311.638.726	512
d0-f8-c22-d0	312.390.574	512
d0-f8-c21-d0	315.309.805	516
d0-f8-c26-d0	320.973.457	526
d0-f8-c16-d0	323.537.803	530
d0-f8-c45-d0	325.319.337	532
d0-f8-c23-d0	327.380.048	536
d0-f8-c17-d0	332.378.687	542
d0-f8-c29-d0	338.256.143	552
d0-f8-c24-d0	340.167.810	554
d0-f8-c25-d0	341.239.625	556
d0-f8-c44-d0	369.953.386	598
d0-f8-c38-d0	374.281.989	606
d0-f8-c49-d0	389.602.059	628
d0-f8-c11-d0	398.080.204	642
d0-f8-c39-d0	401.796.071	646

Distancia total: 8591.764211

Clientes visitados: 32/50

EXPERIMENTOS: RESULTADOS

AB103

Ruta	Distancia	Tiempo
d0-c22-d0	213.637.799	350
d0-c39-d0	225.156.553	366
d0-c36-d0	233.823.555	380
d0-c29-d0	236.091.105	384
d0-c26-d0	237.195.111	384
d0-c40-d0	245.342.924	398
d0-c25-d0	247.323.353	400
d0-c31-d0	261.182.722	420
d0-c32-d0	274.372.664	440
d0-c20-d0	277.968.962	446
d0-c8-d0	283.193.913	454
d0-c7-d0	286.682.035	460
d0-c6-d0	289.816.476	464
d0-c2-d0	299.104.028	478
d0-f8-c41-d0	308.449.428	506
d0-f8-c42-d0	308.449.428	506
d0-f8-c43-d0	308.449.428	506
d0-f8-c3-d0	309.380.327	508
d0-f8-c1-d0	312.390.574	512
d0-f8-c5-d0	313.932.639	514
d0-f8-c17-d0	314.695.356	516
d0-f8-c4-d0	327.380.048	536
d0-f8-c50-d0	373.967.404	604
d0-f8-c35-d0	377.218.289	610

Distancia total: 6865.204121

Clientes visitados: 24/50

EXPERIMENTOS: RESULTADOS

Ruta	Distancia	Tiempo
d0-c45-c40-c41-c16-d0	204.280.735	424
d0-c72-c71-c73-c34-c38-d0	198.886.448	476
d0-c33-c53-c52-c39-f1-c56-d0	299.050.652	609
d0-c51-c23-c22-d0	193.183.486	377
d0-c35-c29-d0	215.296.003	381
d0-c17-d0	214.455.918	350
d0-c70-d0	236.184.552	384
d0-c74-d0	241.346.741	392
d0-c57-d0	245.342.924	398
d0-c15-d0	249.059.931	402
d0-c36-d0	249.372.915	404
d0-c50-d0	276.144.631	444
d0-c18-d0	283.058.234	454
d0-c32-d0	286.604.919	458
d0-c12-d0	288.997.969	462
d0-c10-d0	289.816.476	464
d0-c69-d0	298.701.692	478
d0-c6-d0	299.104.028	478
d0-c30-d0	299.312.296	478
d0-f8-c58-d0	308.449.428	506
d0-f8-c59-d0	308.449.428	506
d0-f8-c60-d0	308.449.428	506
d0-f8-c7-d0	309.380.327	508
d0-f8-c5-d0	312.390.574	512
d0-f8-c9-d0	313.932.639	514
d0-f8-c47-d0	314.695.356	516
d0-f8-c4-d0	315.309.805	516
d0-f8-c11-d0	316.275.457	518
d0-f8-c1-d0	324.617.353	530
d0-f8-c2-d0	324.617.353	530
d0-f8-c3-d0	325.319.337	532
d0-f8-c8-d0	327.380.048	536
d0-f8-c21-d0	335.866.347	548
d0-f8-c55-d0	340.436.816	554
d0-f8-c26-d0	343.735.114	560
d0-f8-c37-d0	352.027.579	572
d0-f8-c24-d0	356.817.451	580
d0-f8-c44-d0	359.573.339	584
d0-f8-c61-d0	374.281.989	606
d0-f8-c48-d0	377.434.821	610
d0-f8-c31-d0	387.464.907	626
d0-f8-c25-d0	389.602.059	628
d0-f8-c42-d0	397.978.618	640
d0-f8-c62-d0	398.080.204	642
d0-f8-c75-d0	401.308.147	646
d0-f8-c63-d0	401.796.071	646
d0-f8-c68-d0	402.778.044	648

AB108

Distancia total: 14596.648590

Clientes visitados: 61/75

Ruta	Distancia	Tiempo
d0-c99-c9-c90-c21-d0	176.924.360	384
d0-c81-c56-c24-c8-d0	192.644.042	406
d0-c93-c34-c97-f17-c77-d0	290.350.025	567
d0-c73-c11-c19-d0	194.630.726	380
d0-c18-c10-c72-d0	199.753.406	388
d0-c39-c14-c55-d0	199.478.829	418
d0-c36-d0	150.104.890	254
d0-f8-c12-c53-d0	300.000.000	465
d0-c59-d0	207.384.758	340
d0-c30-d0	220.826.311	360
d0-c64-d0	225.156.553	366
d0-c41-d0	233.823.555	380
d0-c78-d0	237.195.111	384
d0-c33-d0	237.619.464	386
d0-c54-d0	245.498.889	398
d0-c87-d0	249.885.283	404
d0-c15-d0	254.285.335	410
d0-c16-d0	261.182.722	420
d0-c94-d0	262.015.339	422
d0-c17-d0	274.372.664	440
d0-c13-d0	276.144.631	444
d0-c48-d0	283.058.234	454
d0-c69-d0	283.193.913	454
d0-c68-d0	286.682.035	460
d0-c67-d0	299.104.028	478
d0-f1-c1-d0	302.193.272	497
d0-f1-c5-d0	304.671.397	501
d0-f1-c22-d0	305.288.744	501
d0-f1-c49-d0	309.986.426	509
d0-f1-c66-d0	310.600.876	509
d0-f1-c61-d0	315.369.560	517
d0-f1-c6-d0	315.936.831	517
d0-f1-c95-d0	320.610.407	525
d0-f1-c44-d0	322.671.118	529
d0-f1-c7-d0	331.157.418	541
d0-f1-c40-d0	333.547.214	545
d0-f1-c43-d0	334.820.935	547
d0-f1-c91-d0	335.478.871	547
d0-f1-c96-d0	336.530.695	549
d0-f1-c47-d0	339.026.185	553
d0-f1-c82-d0	345.959.977	563
d0-f1-c98-d0	352.108.522	573
d0-f1-c85-d0	354.101.239	575
d0-f1-c38-d0	358.976.990	583
d0-f1-c65-d0	365.244.457	591
d0-f1-c4-d0	369.258.475	597
d0-f1-c2-d0	369.573.060	599
d0-f1-c76-d0	372.725.892	603
d0-f1-c83-d0	384.702.150	621
d0-f1-c46-d0	384.893.130	621
d0-f1-c89-d0	395.178.746	637
d0-f1-c75-d0	402.542.356	647
d0-f1-c26-d0	406.520.128	653
d0-f1-c57-d0	408.924.642	657

AB117

Distancia total: 16163.875929

Clientes visitados: 70/100

EXPERIMENTOS: RESULTADOS

Ruta	Distancia	Tiempo
d0-c1-f5-c2-d0	284.694.338	358
d0-c5-d0	225.156.553	254
d0-c4-d0	233.823.555	262
d0-c15-d0	233.823.555	262
d0-c16-d0	245.342.924	274
d0-f8-c24-d0	287.902.843	331
d0-f8-c23-d0	291.390.964	335
d0-f8-c22-d0	294.525.406	337
d0-f8-c34-d0	303.812.958	347
d0-f8-c28-d0	304.149.853	347
d0-f8-c6-d0	308.449.428	351
d0-f8-c10-d0	309.380.327	353
d0-f8-c27-d0	311.638.726	355
d0-f8-c33-d0	315.309.805	359
d0-f8-c13-d0	320.973.457	365
d0-f8-c42-d0	323.537.803	367
d0-f8-c9-d0	324.617.353	367
d0-f8-c45-d0	324.617.353	367
d0-f8-c44-d0	339.529.864	383
d0-f8-c11-d0	340.167.810	383
d0-f8-c47-d0	356.817.451	401
d0-f8-c8-d0	370.711.954	415
d0-f8-c32-d0	373.967.404	417
d0-f8-c7-d0	374.281.989	417
d0-f8-c40-d0	375.640.474	419
d0-f8-c3-d0	396.239.503	439
d0-f8-c14-d0	396.239.503	439
d0-f8-c49-d0	401.308.147	445
d0-f8-c17-d0	402.778.044	447
d0-f8-c21-d0	428.634.920	471
d0-f8-c46-d0	449.182.665	493
d0-f8-c31-d0	467.518.999	511
d0-f8-c20-d0	471.554.270	515
d0-f8-c38-d0	471.635.110	515
d0-f8-c25-d0	471.911.580	515
d0-f8-c50-d0	485.800.166	529
d0-f8-c12-d0	489.408.668	533
d0-f8-c19-d0	498.080.480	541
d0-f8-c39-d0	550.608.762	593

AB201

Distancia total: 15775.023522

Clientes visitados: 48/50

CONCLUSIONES

- Dificultad del problema
- ¿Lo bueno? ¿Lo malo?
- Mejoras