

Vehicle Routing - 5 Cities

With Capacity Constraint and No Time Constraint

Cost of Goods Delivery (All Trips) : 563.2 Euros

From(City) - To (City)	Distance(KM)	Speed(KMH)	Time(Hours)	Quantity
'Dublin' -> 'Cork'	218	100	2.18	117
'Cork' -> 'Waterford'	100	100	1.00	70
'Waterford' -> 'Dublin'	133	100	1.33	0
Quantity Delivered	: 187			
Distance Covered	: 451			
Number of Stops in Trip: 3				
---TRIP---				
'Dublin' -> 'Galway'	187	100	1.87	42
'Galway' -> 'Limerick'	73	100	0.73	128
'Limerick' -> 'Cork'	86	100	0.86	117
'Cork' -> 'Waterford'	100	100	1.00	70
'Waterford' -> 'Dublin'	133	100	1.33	0
Quantity Delivered	: 357			
Distance Covered	: 579			
Number of Stops in Trip: 5				
---TRIP---				
'Dublin' -> 'Waterford'	133	60	2.22	70
'Waterford' -> 'Dublin'	133	100	1.33	0
Quantity Delivered	: 70			
Distance Covered	: 266			
Number of Stops in Trip: 2				

Figure 1: Goods Delivery Optimal Cost : With Capacity Constraint - Run1

Cost of Goods Delivery (All Trips) : 640 Euros

From(City) - To (City)	Distance(KM)	Speed(KMH)	Time(Hours)	Quantity
'Dublin' -> 'Galway'	187	100	1.87	46
'Galway' -> 'Cork'	158	100	1.58	155
'Cork' -> 'Limerick'	86	100	0.86	85
'Limerick' -> 'Waterford'	111	100	1.11	54
'Waterford' -> 'Dublin'	133	100	1.33	0
Quantity Delivered	: 340			
Distance Covered	: 675			
Number of Stops in Trip: 5				

Figure 2: Goods Delivery Optimal Cost : With Capacity Constraint - Run2

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Cost of Goods Delivery (All Trips) : 609.067 Euros
From(City) - To (City)      |Distance(KM)|Speed(KMH)|Time(Hours)|Quantity
-----|-----|-----|-----|-----
'Dublin'    -> 'Cork'       |      218 |      100 |      2.18 |      190
'Cork'      -> 'Waterford'  |      100 |      100 |      1.00 |       71
'Waterford' -> 'Dublin'     |      133 |      100 |      1.33 |        0
Quantity Delivered      : 261
Distance Covered       : 451
Number of Stops in Trip: 3
---TRIP---
'Dublin'    -> 'Galway'     |      187 |      100 |      1.87 |       40
'Galway'    -> 'Limerick'   |       73 |      100 |      0.73 |       84
'Limerick'  -> 'Cork'       |       86 |       60 |      1.43 |      190
'Cork'      -> 'Waterford'  |      100 |      100 |      1.00 |       71
'Waterford' -> 'Dublin'     |      133 |      100 |      1.33 |        0
Quantity Delivered      : 385
Distance Covered       : 579
Number of Stops in Trip: 5

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Figure 3: Goods Delivery Optimal Cost : With Capacity Constraint - Run3

With Capacity Constraint and Time Constraint

Cost of Goods Delivery (All Trips) : 1465.07 Euros

From(City) - To (City)	Distance(KM)	Speed(KMH)	Time(Hours)	Quantity
'Dublin' -> 'Cork'	218	100	2.18	134
'Cork' -> 'Dublin'	218	100	2.18	0
Quantity Delivered	: 134			
Distance Covered	: 436			
Number of Stops in Trip	: 2			
---TRIP---				
'Dublin' -> 'Limerick'	175	100	1.75	106
'Limerick' -> 'Dublin'	175	60	2.92	0
Quantity Delivered	: 106			
Distance Covered	: 350			
Number of Stops in Trip	: 2			
---TRIP---				
'Dublin' -> 'Galway'	187	100	1.87	48
'Galway' -> 'Dublin'	187	100	1.87	0
Quantity Delivered	: 48			
Distance Covered	: 374			
Number of Stops in Trip	: 2			
---TRIP---				
'Dublin' -> 'Waterford'	133	60	2.22	54
'Waterford' -> 'Dublin'	133	100	1.33	0
Quantity Delivered	: 54			
Distance Covered	: 266			
Number of Stops in Trip	: 2			

Figure 4: Goods Delivery Optimal Cost : With Capacity Constraint and Time Constraint

Vehicle Routing - 20 Cities

With Capacity Constraint and No Time Constraint

Cost of Goods Delivery (All Trips) : 1324.8 Euros					
From(City) - To (City)	Distance(KM)	Speed(KMH)	Time(Hours)	Quantity	
'Dublin' -> 'Naas'	31	100	0.31	21	
'Naas' -> 'Bray'	38	100	0.38	35	
'Bray' -> 'Swords'	27	100	0.27	15	
'Swords' -> 'Drogheda'	31	100	0.31	38	
'Drogheda' -> 'Dundalk'	33	100	0.33	31	
'Dundalk' -> 'Navan'	43	100	0.43	23	
'Navan' -> 'Athlone'	87	100	0.87	13	
'Athlone' -> 'Sligo'	101	100	1.01	18	
'Sligo' -> 'Galway'	117	100	1.17	96	
'Galway' -> 'Ennis'	46	100	0.46	28	
'Ennis' -> 'Limerick'	32	100	0.32	74	
'Limerick' -> 'Tralee'	85	100	0.85	18	
'Tralee' -> 'Cork'	95	100	0.95	252	
'Cork' -> 'Waterford'	100	100	1.00	38	
'Waterford' -> 'Clonmel'	41	100	0.41	17	
'Clonmel' -> 'Kilkenny'	45	100	0.45	28	
'Kilkenny' -> 'Wexford'	63	100	0.63	21	
'Wexford' -> 'Carlow'	63	100	0.63	10	
'Carlow' -> 'Newbridge'	38	100	0.38	11	
'Newbridge' -> 'Dublin'	40	100	0.40	0	
Quantity Delivered : 787					
Distance Covered : 1156					
Number of Stops in Trip: 20					

Figure 5: Goods Delivery Optimal Cost : With Capacity Constraint - Run1

Cost of Goods Delivery (All Trips) : 1286.13 Euros

From(City) - To (City)	Distance(KM)	Speed(KMH)	Time(Hours)	Quantity
'Dublin' -> 'Swords'	13	60	0.22	12
'Swords' -> 'Navan'	38	100	0.38	12
'Navan' -> 'Drogheda'	22	100	0.22	42
'Drogheda' -> 'Dundalk'	33	100	0.33	39
'Dundalk' -> 'Sligo'	137	100	1.37	12
'Sligo' -> 'Athlone'	101	100	1.01	12
'Athlone' -> 'Galway'	75	100	0.75	76
'Galway' -> 'Ennis'	46	100	0.46	15
'Ennis' -> 'Tralee'	81	100	0.81	28
'Tralee' -> 'Limerick'	85	100	0.85	119
'Limerick' -> 'Cork'	86	100	0.86	244
'Cork' -> 'Clonmel'	72	100	0.72	23
'Clonmel' -> 'Waterford'	41	100	0.41	35
'Waterford' -> 'Wexford'	45	60	0.75	11
'Wexford' -> 'Kilkenny'	63	100	0.63	13
'Kilkenny' -> 'Carlow'	30	100	0.30	20
'Carlow' -> 'Newbridge'	38	100	0.38	14
'Newbridge' -> 'Naas'	9	100	0.09	14
'Naas' -> 'Bray'	38	100	0.38	35
'Bray' -> 'Dublin'	16	100	0.16	0
Quantity Delivered	: 776			
Distance Covered	: 1069			
Number of Stops in Trip	: 20			

Figure 6: Goods Delivery Optimal Cost : With Capacity Constraint - Run2

Cost of Goods Delivery (All Trips) : 1228.8 Euros					
From(City) - To (City)	Distance(KM)	Speed(KMH)	Time(Hours)	Quantity	
'Dublin' -> 'Naas'	31	100	0.31	22	
'Naas' -> 'Newbridge'	9	100	0.09	12	
'Newbridge' -> 'Carlow'	38	100	0.38	25	
'Carlow' -> 'Kilkenny'	30	100	0.30	24	
'Kilkenny' -> 'Wexford'	63	100	0.63	25	
'Wexford' -> 'Waterford'	45	100	0.45	56	
'Waterford' -> 'Clonmel'	41	100	0.41	9	
'Clonmel' -> 'Cork'	72	100	0.72	208	
'Cork' -> 'Tralee'	95	100	0.95	25	
'Tralee' -> 'Limerick'	85	100	0.85	114	
'Limerick' -> 'Ennis'	32	100	0.32	29	
'Ennis' -> 'Galway'	46	100	0.46	67	
'Galway' -> 'Athlone'	75	100	0.75	18	
'Athlone' -> 'Sligo'	101	100	1.01	25	
'Sligo' -> 'Dundalk'	137	100	1.37	26	
'Dundalk' -> 'Drogheda'	33	100	0.33	40	
'Drogheda' -> 'Navan'	22	100	0.22	11	
'Navan' -> 'Swords'	38	100	0.38	30	
'Swords' -> 'Bray'	27	100	0.27	25	
'Bray' -> 'Dublin'	16	100	0.16	0	
Quantity Delivered : 791					
Distance Covered : 1036					
Number of Stops in Trip: 20					

Figure 7: Goods Delivery Optimal Cost : With Capacity Constraint - Run3

With Capacity Constraint and Time Constraint

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Cost of Goods Delivery (All Trips) : 4914.13 Euros
From(City) - To (City) |Distance(KM)|Speed(KMH)|Time(Hours)|Quantity
-----|-----|-----|-----|-----
'Dublin' -> 'Cork' | 218 | 60 | 3.63 | 256
'Cork' -> 'Dublin' | 218 | 100 | 2.18 | 0
Quantity Delivered : 256
Distance Covered : 436
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Limerick' | 175 | 60 | 2.92 | 76
'Limerick' -> 'Dublin' | 175 | 60 | 2.92 | 0
Quantity Delivered : 76
Distance Covered : 350
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Galway' | 187 | 100 | 1.87 | 52
'Galway' -> 'Dublin' | 187 | 60 | 3.12 | 0
Quantity Delivered : 52
Distance Covered : 374
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Waterford' | 133 | 100 | 1.33 | 32
'Waterford' -> 'Dublin' | 133 | 100 | 1.33 | 0
Quantity Delivered : 32
Distance Covered : 266
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Dundalk' | 77 | 100 | 0.77 | 51
'Dundalk' -> 'Dublin' | 77 | 100 | 0.77 | 0
Quantity Delivered : 51
Distance Covered : 154
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Bray' | 16 | 100 | 0.16 | 38
'Bray' -> 'Dublin' | 16 | 60 | 0.27 | 0
Quantity Delivered : 38
Distance Covered : 32
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Drogheda' | 44 | 100 | 0.44 | 23
'Drogheda' -> 'Dublin' | 44 | 100 | 0.44 | 0
Quantity Delivered : 23
Distance Covered : 88
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Swords' | 13 | 60 | 0.22 | 17
'Swords' -> 'Dublin' | 13 | 100 | 0.13 | 0
Quantity Delivered : 17
Distance Covered : 26
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Tralee' | 261 | 100 | 2.61 | 13
'Tralee' -> 'Dublin' | 261 | 100 | 2.61 | 0
Quantity Delivered : 13
Distance Covered : 522
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Kilkenny' | 100 | 60 | 1.67 | 21
'Kilkenny' -> 'Dublin' | 100 | 100 | 1.00 | 0
Quantity Delivered : 21
Distance Covered : 200
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Ennis' | 190 | 60 | 3.17 | 14
'Ennis' -> 'Dublin' | 190 | 100 | 1.90 | 0
Quantity Delivered : 14
Distance Covered : 380
Number of Stops in Trip: 2
---TRIP---
'Dublin' -> 'Sligo' | 180 | 100 | 1.80 | 22
'Sligo' -> 'Dublin' | 180 | 100 | 1.80 | 0
Quantity Delivered : 22
Distance Covered : 360
Number of Stops in Trip: 2
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Figure 8: Goods Delivery Optimal Cost : With Capacity Constraint and Time Constraint

Vehicle Routing - 30 Cities

With Capacity Constraint and No Time Constraint

Cost of Goods Delivery (All Trips) : 1690.67 Euros

From(City) - To (City) |Distance(KM)|Speed(KMH)|Time(Hours)|Quantity

Dublin	-> Leixlip	16	100	0.16	13
Leixlip	-> Celbridge	5	100	0.05	13
Celbridge	-> Maynooth	6	100	0.06	10
Maynooth	-> Navan	31	100	0.31	23
Navan	-> Drogheda	22	100	0.22	17
Drogheda	-> Dundalk	33	100	0.33	46
Dundalk	-> Letterkenny	133	100	1.33	8
Letterkenny	-> Sligo	87	100	0.87	21
Sligo	-> Mullingar	112	100	1.12	14
Mullingar	-> Tullamore	29	100	0.29	13
Tullamore	-> Athlone	34	100	0.34	24
Athlone	-> Galway	75	100	0.75	71
Galway	-> Killarney	39	100	0.39	12
Killarney	-> Ennis	41	100	0.41	12
Ennis	-> Limerick	32	60	0.53	104
Limerick	-> Tralee	85	100	0.85	13
Tralee	-> Cork	95	100	0.95	235
Cork	-> Clonmel	72	100	0.72	18
Clonmel	-> Waterford	41	100	0.41	53
Waterford	-> Wexford	45	100	0.45	17
Wexford	-> Kilkenny	63	100	0.63	29
Kilkenny	-> Carlow	30	100	0.30	12
Carlow	-> Port laoise	33	100	0.33	15
Port laoise	-> Newbridge	36	100	0.36	10
Newbridge	-> Naas	9	60	0.15	15
Naas	-> Dublin	31	100	0.31	0

Quantity Delivered : 818

Distance Covered : 1235

Number of Stops in Trip: 26

---TRIP---

Dublin	-> Greystones	24	100	0.24	7
Greystones	-> Bray	8	100	0.08	35
Bray	-> Malahide	26	100	0.26	12
Malahide	-> Swords	3	60	0.05	33
Swords	-> Dublin	13	100	0.13	0

Quantity Delivered : 87

Distance Covered : 74

Number of Stops in Trip: 5

Figure 9: Goods Delivery Optimal Cost : With Capacity Constraint - Run1

Cost of Goods Delivery (All Trips) : 1672.8 Euros

From(City) - To (City)	Distance(KM)	Speed(KMH)	Time(Hours)	Quantity
Dublin -> Malahide	14	100	0.14	8
Malahide -> Swords	3	100	0.03	32
Swords -> Navan	38	100	0.38	16
Navan -> Drogheda	22	100	0.22	41
Drogheda -> Dundalk	33	100	0.33	23
Dundalk -> Letterkenny	133	100	1.33	18
Letterkenny -> Sligo	87	100	0.87	25
Sligo -> Mullingar	112	100	1.12	18
Mullingar -> Tullamore	29	100	0.29	16
Tullamore -> Athlone	34	100	0.34	15
Athlone -> Galway	75	100	0.75	63
Galway -> Killarney	39	100	0.39	9
Killarney -> Ennis	41	100	0.41	23
Ennis -> Tralee	81	100	0.81	23
Tralee -> Limerick	85	100	0.85	76
Limerick -> Cork	86	100	0.86	247
Cork -> Clonmel	72	100	0.72	11
Clonmel -> Waterford	41	100	0.41	43
Waterford -> Wexford	45	100	0.45	16
Wexford -> Kilkenny	63	100	0.63	17
Kilkenny -> Carlow	30	100	0.30	10
Carlow -> Port laoise	33	100	0.33	5
Port laoise -> Newbridge	36	100	0.36	21
Newbridge -> Naas	9	100	0.09	25
Naas -> Celbridge	15	60	0.25	23
Celbridge -> Maynooth	6	100	0.06	12
Maynooth -> Leixlip	7	100	0.07	10
Leixlip -> Bray	30	100	0.30	33
Bray -> Greystones	8	100	0.08	11
Greystones -> Dublin	24	100	0.24	0
Quantity Delivered : 890				
Distance Covered : 1331				
Number of Stops in Trip: 30				

Figure 10: Goods Delivery Optimal Cost : With Capacity Constraint - Run2

Cost of Goods Delivery (All Trips) : 1668.27 Euros

From(City) - To (City) |Distance(KM)|Speed(KMH)|Time(Hours)|Quantity

Dublin	-> Swords	13	100	0.13	23
Swords	-> Malahide	3	100	0.03	13
Malahide	-> Greystones	35	100	0.35	10
Greystones	-> Bray	8	100	0.08	46
Bray	-> Dublin	16	100	0.16	0
Quantity Delivered : 92					
Distance Covered : 75					
Number of Stops in Trip: 5					
---TRIP---					
Dublin	-> Maynooth	23	100	0.23	13
Maynooth	-> Leixlip	7	100	0.07	12
Leixlip	-> Celbridge	5	100	0.05	15
Celbridge	-> Naas	15	100	0.15	11
Naas	-> Newbridge	9	100	0.09	17
Newbridge	-> Port laoise	36	100	0.36	8
Port laoise	-> Kilkenny	42	100	0.42	14
Kilkenny	-> Carlow	30	100	0.30	13
Carlow	-> Wexford	63	100	0.63	15
Wexford	-> Waterford	45	100	0.45	54
Waterford	-> Clonmel	41	100	0.41	23
Clonmel	-> Cork	72	100	0.72	164
Cork	-> Tralee	95	100	0.95	26
Tralee	-> Limerick	85	100	0.85	75
Limerick	-> Ennis	32	100	0.32	24
Ennis	-> Killarney	41	60	0.68	16
Killarney	-> Galway	39	100	0.39	44
Galway	-> Athlone	75	100	0.75	27
Athlone	-> Tullamore	34	100	0.34	16
Tullamore	-> Mullingar	29	100	0.29	18
Mullingar	-> Sligo	112	100	1.12	12
Sligo	-> Letterkenny	87	100	0.87	12
Letterkenny	-> Dundalk	133	100	1.33	50
Dundalk	-> Navan	43	100	0.43	22
Navan	-> Drogheda	22	100	0.22	36
Drogheda	-> Swords	31	100	0.31	23
Swords	-> Malahide	3	100	0.03	13
Malahide	-> Greystones	35	100	0.35	10
Greystones	-> Bray	8	100	0.08	46
Bray	-> Dublin	16	100	0.16	0
Quantity Delivered : 829					
Distance Covered : 1308					
Number of Stops in Trip: 30					

Figure 11: Goods Delivery Optimal Cost : With Capacity Constraint - Run3

With Capacity Constraint and Time Constraint

Cost of Goods Delivery (All Trips) : 6270.93 Euros

From(City) - To (City)		Distance(KM)	Speed(KMH)	Time(Hours)	Quantity

Dublin	-> Cork	218	100	2.18	104
Cork	-> Dublin	218	100	2.18	0
Quantity Delivered : 104					
Distance Covered : 436					
Number of Stops in Trip: 2					
---TRIP---					
Dublin	-> Limerick	175	100	1.75	113
Limerick	-> Dublin	175	100	1.75	0
Quantity Delivered : 113					
Distance Covered : 350					
Number of Stops in Trip: 2					
---TRIP---					
Dublin	-> Galway	187	100	1.87	59
Galway	-> Dublin	187	100	1.87	0
Quantity Delivered : 59					
Distance Covered : 374					
Number of Stops in Trip: 2					
---TRIP---					
Dublin	-> Waterford	133	100	1.33	30
Waterford	-> Dublin	133	100	1.33	0
Quantity Delivered : 30					
Distance Covered : 266					
Number of Stops in Trip: 2					
---TRIP---					
Dublin	-> Dundalk	77	100	0.77	30
Dundalk	-> Dublin	77	100	0.77	0
Quantity Delivered : 30					
Distance Covered : 154					

Figure 12: Goods Delivery Optimal Cost : With Capacity Constraint and Time Constraint