Final Exam

Open Book: 70 points (70%)

1. Consideration is being given to increasing the toll on a bridge now carrying 4500 veh/day. The current toll is $1.25/veh. It has been found from past experience that the daily traffic volume will decrease by 400 veh/day for each 25 cents increase in toll. Therefore, if x is the increase in toll in cents/veh, the volume equation for veh/day is $V=4500-400(x/25)$, and the new toll/veh would be $T=125+x$. In order to maximize revenues, what would the new toll charge be per vehicle, and what would the traffic in veh/day be after the toll increase? How much additional revenue will be generated?
2. Using the tables below, estimate balanced trip generation and distribution?

Zone Production model for work trips: $Trips=0.82\*households$

Zone attraction model for work trips: $Trips=2,500+\frac{AnnualIncome}{3000}+\frac{OfficeSpace (ft^{2})}{250}$

**Table: Socioeconomic and Employment Data from the US Census**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Zone | Households | Income | Cars | Size | Workers | Office space (ft2) | Retail space (ft2) |
| 1 | 23,000 | 30,000 | 1.4 | 2.1 | 1.4 | 2.00E+06 | 5.00E+06 |
| 2 | 35,000 | 25,000 | 1.8 | 2.2 | 1.6 | 3.00E+06 | 1.50E+07 |
| 3 | 85,000 | 55,000 | 2.5 | 2.3 | 1.5 | 1.00E+07 | 1.00E+07 |
| 4 | 15,000 | 85,000 | 1.1 | 1.5 | 1.3 | 2.50E+07 | 2.00E+07 |

**Table: Friction factor**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   | 1 | 2 | 3 | 4 |
| 1 | 0.20 | 0.07 | 0.07 | 0.04 |
| 2 | 0.07 | 0.20 | 0.04 | 0.07 |
| 3 | 0.07 | 0.04 | 0.20 | 0.07 |
| 4 | 0.04 | 0.07 | 0.07 | 0.20 |

1. Two transportation projects have been proposed in increase the safety in and around a residential neighborhood. Each project consists of upgrading existing street signing to highly retro reflective sheeting to increase visibility. The following table shows the initial construction costs, annual operating costs, useful life of the sheeting, and the salvage values for each alternative. Assume that the discount rate is 10%. Calculate the present values for each alternative.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Alternative | Initial Construction Costs ($) | Annual Operating Costs ($) | Useful Life (Years) | Salvage Value ($) |
| I | 10,000 | 900 | 10 | 2,500 |
| II | 12,000 | 1,500 | 6 | 5,000 |

1. Find shortest path using Dijkstra’s Algorithm.

150

165

145

275

155

340

95

260

85

1400

110

45

130

285

200

300

65

130