**Problem 1.** Calculate existing pavement serviceability index (PSI) of a roadway segment starts point A and ends B? What would be the next year PSI? The PCI of this segment is 75. A typical pavement deterioration data is given in the table below.



**A**

**B**



|  |  |
| --- | --- |
| **Year** | **PSI** |
| 1 | 4.5 |
| 2 | 4 |
| 3 | 3.5 |
| 4 | 3.25 |
| 5 | 2.5 |
| 6 | 2 |
| 7 | 1.25 |
| 8 | 1 |

$$PSI=5.35e^{-0.0058\*IRI} -4RUT^{2}-3\left(1-\left(\frac{PCI}{100}\right)\right)$$

**Problem 2.** Develop a pavement deterioration model applying Markovian probabilistic technique using the data below.

|  |  |
| --- | --- |
| **Road No** | **PSI** |
| **Year1**  | **Year1+1** |
| 1 | 4.5 | 4.18 |
| 2 | 3.7 | 3.60 |
| 3 | 3.5 | 3.22 |
| 4 | 2.5 | 2.08 |
| 5 | 3.5 | 3.22 |
| 6 | 3.5 | 3.22 |
| 7 | 2.5 | 2.08 |
| 8 | 1.5 | 1.35 |
| 9 | 2.5 | 2.08 |
| 10 | 3.8 | 3.70 |
| 11 | 1.5 | 1.35 |
| 12 | 4.5 | 4.18 |
| 13 | 1.5 | 1.35 |
| 14 | 2.5 | 2.08 |
| 15 | 1.5 | 1.35 |
| 16 | 3.5 | 3.22 |
| 17 | 3.5 | 3.22 |
| 18 | 4.5 | 4.18 |
| 19 | 3.5 | 3.22 |
| 20 | 4.6 | 4.55 |
| 21 | 2.9 | 2.51 |
| 22 | 1.6 | 1.51 |
| 23 | 1.7 | 1.65 |
| 24 | 3.5 | 3.22 |
| 25 | 3.5 | 3.22 |
| 26 | 4.5 | 4.18 |
| 27 | 1.8 | 1.65 |
| 28 | 2.5 | 2.08 |
| 29 | 3.5 | 3.22 |
| 30 | 1.5 | 1.35 |

**Problem 3:** Using the data below, estimate balanced trip productions and attractions for all zones?

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Zone | Households | Income | Cars | Size | Workers per HH | 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 | 75,000 | 55,000 | 2.5 | 2.3 | 1.5 | 1.00E+07 | 1.00E+07 |

Trip Generation model, trip productions per HH = 0.3+0.75\*workers per HH

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

**Problem 4:** Using the data below, estimate trip distribution for TAZ 4.

|  |  |
| --- | --- |
| Travel time (min) | Friction Factor |
| 3 | 87 |
| 4 | 45 |
| 7 | 29 |
| 10 | 18 |
| 15 | 10 |
| 20 | 6 |
| 25 | 4 |

|  |  |  |
| --- | --- | --- |
| TAZ | Productions | Attractions |
| 1 | 234 | 972 |
| 2 | 76 | 478 |
| 3 | 602 | 68 |
| 4 | 432 | 42 |
| 5 | 472 | 74 |

|  |
| --- |
| ZONE DISTANCES (Minutes) |
|  | 1 | 2 | 3 | 4 | 5 |
| 1 | 4 | 15 | 15 | 25 | 10 |
| 2 | 15 | 4 | 25 | 15 | 7 |
| 3 | 15 | 25 | 4 | 15 | 7 |
| 4 | 25 | 15 | 15 | 4 | 20 |
| 5 | 5 | 10 | 7 | 7 | 4 |