**Course: Transportation Planning and Management Program: MS**

**Exam: Final Term Exam**

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**ID No: 14373**

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**Ans Q#1.**

 **Trip distribution of 8-zones required in question by using Gravity model**

 **Abbreviations used in question are:**

 **Ai Attractiveness**

 **Wij  Interzonal impedance**

**i Origin zone**

**j Destination Zone**

**Tij  Trips produced at zone i & attracted to zone j**

**Pi Trips produced from zone i**

**Aj Trips attracted to zone j**

**Wij Impedance for interchange ij**

**C Exponent of impedance term, in question it is given 3**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Zone,+D8:M22 i | **Name** | **Trip Productions, Pi** | **Attractiveness, Ai** |   |   |   |   |   |   |
| 1 | peshawar | 67000 | 45 |  |  |  |  |  |   |
| 2 | Charsada | 63300 | 37 |  |  |  |  |  |   |
| 3 | Mardan | 59400 | 24 |  |  |  |  |  |   |
| 4 | Nowshera | 56200 | 28 |  |  |  |  |  |   |
| 5 | swabi | 53100 | 24 |  |  |  |  |  |   |
| 6 | Abbot abad | 50300 | 14 |  |  |  |  |  |   |
| 7 | Kohat | 47800 | 21 |  |  |  |  |  |   |
| 8 | DI khan | 51500 | 13 |  |  |  |  |  |   |
|   |  | for I=1 P1=67000 |  |  |  |   |
| Zone i |   | Interzonal impedance Wij |  |  |  |   |
|   | Zone j |  |  |  |   |
|   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | peshawar | 45 | 30 | 45 | 37 | 60 | 240 | 45 | 480 |
| 2 | Charsada | 30 | 30 | 25 | 30 | 45 | 220 | 60 | 500 |
| 3 | Mardan | 45 | 25 | 30 | 15 | 30 | 195 | 85 | 535 |
| 4 | Nowshera | 37 | 30 | 15 | 25 | 30 | 180 | 105 | 547 |
| 5 | swabi | 60 | 45 | 30 | 30 | 35 | 170 | 115 | 580 |
| 6 | Abbot abad | 240 | 220 | 195 | 180 | 170 | 27 | 280 | 725 |
| 7 | Kohat | 45 | 60 | 85 | 105 | 280 | 230 | 30 | 440 |
| 8 | DI khan | 480 | 500 | 535 | 547 | 580 | 725 | 440 | 25 |
|   |  |  |  |  |  |  |  |  |   |
|   |  |  |  |  |  |  |  |  |   |
| **For i =1, P1 = 67000** |  |   |
| **j** |  | aj | F1j | K1j | aj F1jK1j | P1j | Q1j |  |   |
| **1** | peshawar | 45 | 1.1E-05 | 1 | 0.0004938 | 0.163354 | 10945 |  |   |
| **2** | Charsada | 37 | 4E-05 | 1 | 0.0013704 | 0.453308 | 28694 |  |   |
| **3** | Mardan | 24 | 1E-05 | 1 | 0.0002634 | 0.087122 | 5175 |  |   |
| **4** | Nowshera | 28 | 2E-05 | 1 | 0.0005528 | 0.182855 | 10276 |  |   |
| **5** | swabi | 24 | 5E-06 | 1 | 0.0001111 | 0.036755 | 1952 |  |   |
| **6** | Abbot abad | 14 | 7E-08 | 1 | 0.0000010 | 0.000335 | 17 |  |   |
| **7** | Kohat | 21 | 1E-05 | 1 | 0.0002305 | 0.076232 | 3644 |  |   |
| **8** | DI khan | 13 | 9E-09 | 1 | 0.0000001 | 3.89E-05 | 2 |  |   |
| **Total** | 0.0030 | 1 | 60705 |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   |  |  |  |  |  |  |  |  |   |
| **For i =2, P3 = 63300** |  |   |
| **j** |  | aj | F3j | K3j | aj F3jK3j | P3j | Q3j |  |   |
| **1** | peshawar | 45 | 3.7E-05 | 1 | 0.001666667 | 0.279076 | 17666 |  |   |
| **2** | Charsada | 37 | 3.7E-05 | 1 | 0.00137037 | 0.229462 | 13630 |  |   |
| **3** | Mardan | 24 | 0.000064 | 1 | 0.001536 | 0.257196 | 14454 |  |   |
| **4** | Nowshera | 28 | 3.7E-05 | 1 | 0.001037037 | 0.173647 | 9221 |  |   |
| **5** | swabi | 24 | 1.1E-05 | 1 | 0.000263374 | 0.044101 | 2218 |  |   |
| **6** | Abbot abad | 14 | 9.39E-08 | 1 | 1.3148E-06 | 0.00022 | 11 |  |   |
| **7** | Kohat | 21 | 4.63E-06 | 1 | 9.72222E-05 | 0.016279 | 838 |  |   |
| **8** | DI khan | 13 | 8E-09 | 1 | 0.000000104 | 1.74E-05 | 1 |  |   |
|  |  |   |   |   | 0.00597209 |   |   |  |   |
|  |  |   |   |   |   |   |   |  |   |
| **For i =, P3 = 59400** |  |   |
| **j** |  | aj | F3j | K3j | aj F3jK3j | P3j | Q3j |  |   |
| **1** | peshawar | 45 | 1.1E-05 | 1 | 0.000493827 | 0.038068 | 2261.269 |  |   |
| **2** | Charsada | 37 | 0.000064 | 1 | 0.002368 | 0.182546 | 10843.24 |  |   |
| **3** | Mardan | 24 | 3.7E-05 | 1 | 0.000888889 | 0.068523 | 4070.284 |  |   |
| **4** | Nowshera | 28 | 0.000296 | 1 | 0.008296296 | 0.639551 | 37989.31 |  |   |
| **5** | swabi | 24 | 3.7E-05 | 1 | 0.000888889 | 0.068523 | 4070.284 |  |   |
| **6** | Abbot abad | 14 | 1.35E-07 | 1 | 1.8881E-06 | 0.000146 | 8.645724 |  |   |
| **7** | Kohat | 21 | 1.63E-06 | 1 | 3.4195E-05 | 0.002636 | 156.5812 |  |   |
| **8** | DI khan | 13 | 6.53E-09 | 1 | 8.4895E-08 | 6.54E-06 | 0.38874 |  |   |
|  |  |   |   |   | 0.012972069 |   |   |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   |  |  |  |  |  |  |  |  |   |
| **For i =4, P4= 56200** |  |   |
| **j** |  | aj | F3j | K3j | aj F3jK3j | P3j | Q3j |  |   |
| **1** | peshawar | 45 | 1.97E-05 | 1 | 0.000888398 | 0.073595 | 4136.056 |  |   |
| **2** | Charsada | 37 | 3.7E-05 | 1 | 0.00137037 | 0.113522 | 6379.947 |  |   |
| **3** | Mardan | 24 | 0.000296 | 1 | 0.007111111 | 0.589088 | 33106.75 |  |   |
| **4** | Nowshera | 28 | 0.000064 | 1 | 0.001792 | 0.14845 | 8342.901 |  |   |
| **5** | swabi | 24 | 3.7E-05 | 1 | 0.000888889 | 0.073636 | 4138.344 |  |   |
| **6** | Abbot abad | 14 | 1.71E-07 | 1 | 2.40055E-06 | 0.000199 | 11.17608 |  |   |
| **7** | Kohat | 21 | 8.64E-07 | 1 | 1.81406E-05 | 0.001503 | 84.456 |  |   |
| **8** | DI khan | 13 | 6.11E-09 | 1 | 7.94294E-08 | 6.58E-06 | 0.369795 |  |   |
|  |  |   |   |   | 0.012071388 |   |   |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   | For i= P5=53100 |  |  |  |  |  |   |
| **j** |  | aj | F3j | K3j | aj F3jK3j | P3j | Q3j |  |   |
| **1** | peshawar | 45 | 4.63E-06 | 1 | 0.000208333 | 0.067119 | 3564.025 |  |   |
| **2** | Charsada | 37 | 1.1E-05 | 1 | 0.000406036 | 0.130813 | 6946.182 |  |   |
| **3** | Mardan | 24 | 3.7E-05 | 1 | 0.000888889 | 0.286375 | 15206.51 |  |   |
| **4** | Nowshera | 28 | 3.7E-05 | 1 | 0.001037037 | 0.334104 | 17740.92 |  |   |
| **5** | swabi | 24 | 2.33E-05 | 1 | 0.000559767 | 0.180341 | 9576.109 |  |   |
| **6** | Abbot abad | 14 | 2.04E-07 | 1 | 2.84958E-06 | 0.000918 | 48.74872 |  |   |
| **7** | Kohat | 21 | 4.56E-08 | 1 | 9.56633E-07 | 0.000308 | 16.36542 |  |   |
| **8** | DI khan | 13 | 5.13E-09 | 1 | 6.66284E-08 | 2.15E-05 | 1.139833 |  |   |
|  |  |   |   |   | 0.003103935 |   |   |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   | For i= P6=50300 |  |  |  |  |  |   |
| **j** |  | aj | F3j | K3j | aj F3jK3j | P3j | Q3j |  |   |
| **1** | peshawar | 45 | 7.23E-08 | 1 | 3.25521E-06 | 0.004443 | 223 |  |   |
| **2** | Charsada | 37 | 9.39E-08 | 1 | 3.47483E-06 | 0.004743 | 239 |  |   |
| **3** | Mardan | 24 | 1.35E-07 | 1 | 3.23674E-06 | 0.004418 | 222 |  |   |
| **4** | Nowshera | 28 | 1.71E-07 | 1 | 4.8011E-06 | 0.006553 | 330 |  |   |
| **5** | swabi | 24 | 2.04E-07 | 1 | 4.885E-06 | 0.006667 | 335 |  |   |
| **6** | Abbot abad | 14 | 5.08E-05 | 1 | 0.000711274 | 0.970775 | 48830 |  |   |
| **7** | Kohat | 21 | 8.22E-08 | 1 | 1.72598E-06 | 0.002356 | 118 |  |   |
| **8** | DI khan | 13 | 2.62E-09 | 1 | 3.41137E-08 | 4.66E-05 | 2 |  |   |
|  |  |   |   |   | 0.000732687 |   |   |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   | For i= P7=478090 |  |  |  |  |  |   |
| **j** |  | aj | F3j | K3j | aj F3jK3j | P3j | Q3j |  |   |
| **1** | peshawar | 45 | 1.1E-05 | 1 | 0.000493827 | 0.324302 | 15502 |  |   |
| **2** | Charsada | 37 | 4.63E-06 | 1 | 0.000171296 | 0.112492 | 5377 |  |   |
| **3** | Mardan | 24 | 1.63E-06 | 1 | 3.908E-05 | 0.025664 | 1227 |  |   |
| **4** | Nowshera | 28 | 8.64E-07 | 1 | 2.41875E-05 | 0.015884 | 759 |  |   |
| **5** | swabi | 24 | 6.58E-07 | 1 | 1.57804E-05 | 0.010363 | 495 |  |   |
| **6** | Abbot abad | 14 | 4.56E-08 | 1 | 6.37755E-07 | 0.000419 | 20 |  |   |
| **7** | Kohat | 21 | 3.7E-05 | 1 | 0.000777778 | 0.510775 | 24415 |  |   |
| **8** | DI khan | 13 | 1.17E-08 | 1 | 1.52611E-07 | 0.0001 | 5 |  |   |
|  |  |   |   |   | 0.001522739 |   |   |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   | For i= P8=51500 |  |  |  |  |  |   |
| **j** |  | aj | F3j | K3j | aj F3jK3j | P3j | Q3j |  |   |
| **1** | peshawar | 45 | 9.04E-09 | 1 | 4.06901E-07 | 0.000488 | 25 |  |   |
| **2** | Charsada | 37 | 8E-09 | 1 | 0.000000296 | 0.000355 | 18 |  |   |
| **3** | Mardan | 24 | 6.53E-09 | 1 | 1.56729E-07 | 0.000188 | 10 |  |   |
| **4** | Nowshera | 28 | 6.11E-09 | 1 | 1.71079E-07 | 0.000205 | 11 |  |   |
| **5** | swabi | 24 | 5.13E-09 | 1 | 1.23006E-07 | 0.000148 | 8 |  |   |
| **6** | Abbot abad | 14 | 2.62E-09 | 1 | 3.67379E-08 | 4.41E-05 | 2 |  |   |
| **7** | Kohat | 21 | 1.17E-08 | 1 | 2.46525E-07 | 0.000296 | 15 |  |   |
| **8** | DI khan | 13 | 0.000064 | 1 | 0.000832 | 0.998276 | 51411 |  |   |
|  |  |   |   |   | 0.000833437 |   |   |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   |  |  |  |  |  |  |  |  |   |
|   |  | **A1** | **54322** |  |  |  |  |  |   |
|   |  | **A2** | **72128** |  |  |  |  |  |   |
|   |  | **A3** | **73472** |  |  |  |  |  |   |
|   |  | **A4** | **84670** |  |  |  |  |  |   |
|   |  | **A5** | **22793** |  |  |  |  |  |   |
|   |  | **A6** | **48948** |  |  |  |  |  |   |
|   |  | **A7** | **29288** |  |  |  |  |  |   |
|   |   | **A8** | **51423** |   |   |   |   |   |   |

**AnsQ# 2:**

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**Q.3.**

Solution # 3:

Link array for the given network:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Zone** **( i / j )**  | A | B | C | D | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| A |  |  |  |  | 4 |  |  |  |  |  |  |  |  |
| B |  |  |  |  |  |  | 3 |  |  |  |  |  |  |
| C |  |  |  |  |  |  |  |  |  |  | 5 |  |  |
| D |  |  |  |  |  |  |  |  |  |  |  |  | 4 |
| 1 |  |  |  |  |  | 3 |  | 3 |  |  |  |  |  |
| 2 |  |  |  |  | 3 |  | 4 |  | 4 |  |  |  |  |
| 3 |  | 3 |  |  |  | 4 |  |  |  | 12 |  |  |  |
| 4 |  |  |  |  | 3 |  |  |  | 5 |  | 7 |  |  |
| 5 |  |  |  |  |  | 4 |  | 5 |  | 7 |  | 8 |  |
| 6 |  |  |  |  |  |  | 12 |  | 7 |  |  |  | 9 |
| 7 |  |  | 5 |  |  |  |  | 7 |  |  |  | 10 |  |
| 8 |  |  |  |  |  |  |  |  | 8 |  | 10 |  | 12 |
| 9 |  |  |  | 4 |  |  |  |  |  | 9 |  | 12 |  |

Calculating Impedance from Zone-1 to all other zones and nodes:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Stage N** | **Link** | **Compute new path impedance** | **Compare to tree table Stage N-1** | **Decision**  |
| **i** | **j** |
| I | A | 1 | 0 | 4 | 4 | 4< Infinity | Accepted |
| II | 1 | 2 | 4 | 3 | 7 | 7 < Infinity | Accepted |
| 1 | 4 | 4 | 3 | 7 | 7 < Infinity | Accepted |
| III | 2 | 3 | 7 | 4 | 11 | 11 < Infinity | Accepted |
| 2 | 5 | 7 | 4 | 11 | 11 < Infinity | Accepted |
| 4 | 5 | 7 | 5 | 12 | 12 > 11 | Rejected |
| 4 | 7 | 7 | 7 | 14 | 14< Infinity | Accepted |
| IV  | 3 | B | 11 | 3 | 14 | 15< Infinity | Rejected |
| 3 | 6 | 11 | 12 | 23 | 23 >18 | Rejected |
| 5 | 6 | 11 | 7 | 18 | 18< Infinity | Accepted |
| 5 | 8 | 11 | 8 | 19 | 19< Infinity | Accepted |
| 7 | C | 14 | 5 | 19 | 19< Infinity | Accepted |
| 7 | 8 | 14 | 10 | 24 | 24 > 19 | Rejected |
| V | 6 | 9 | 19 | 9 | 29 | 19< Infinity | Accepted |
| 8 | 9 | 19 | 12 | 31 | 31 > 29 | Rejected |
| VI | 9 | D | 31 | 4 | 35 | 35< Infinity | Accepted |

**Ans Q#4.**

#  QUESTION NO: 04

Using net present value calculations are given below

1. CNG bus

 (25uspwf (7%,11)-60 -(16.048+7.99)uspwf(7%,11)+7.04sppwf(7%,11)=-49.44

1. BUS RAPID TRANSIT

27uspwf(7%,12)-50 –(19.589+12.116)uspwf(7%,122)+11sppwf(7%,12)=-82.49

1. LIGHT RAIL

29uspwf(5%,12)-66 – (19.554+16)uspwf(5%,12)+14sppwf(5%,12)=-116.294

1. FAST TRAIN

45uspwf(8%,14)-95-(31.132+19.345)uspwf(8%,14)+17sppwf(8%,14)=-134.367

1. METRO

35uspwf(6%,18)-70-(25+19.535)uspwf(6%,18)+16sppwf(6%,18)=-167.64

# CONCLUSION:

 Since value of CNG Bus is smaller than others alternatives. So, I will recommend CNG Bus for the government.