

### Question 1

- What are the factors affecting Modal Split?

### Question 2

The utility function for a specific zone was calibrated and it was expressed as:

$$U_k = a_k - 0.025 X_1 - 0.032 X_2 - 0.015 X_3 - 0.03 X_4$$

Where  $U_k$  value of the utility function for the transportation facility  $K$

$X_1$  = time for the traveler to reach the transportation facility in minutes.

$X_2$  = waiting time in minutes.

$X_3$  = actual time for the trip.

$X_4$  = trip cost in Penny.

The number of trips between a pair of zones in the future year was 4500 trip/ day, and the traveler between these two zones can use either coach (A) or private car (B). The characteristics of service for both two facilities in the future year is expected to be as follow:

Characteristic/variable	$X_1$	$X_2$	$X_3$	$X_4$
Private car	5	0	20	100
Coach	10	13	40	55

- Assume that the constant ( $a_k$ ) for the coach = -0.56 and for the private car = - 0.12. Find the number of travelers using each of the two facilities; also calculate the income of the Coach Company/ month.
- Calculate the effect of decreasing the trip fare to be 35 pence and the effect of construction new coach stops to decrease the waiting time to be 7 minutes on the income of the coach company.

### Question 3

There are three alternatives to improve the efficiency of a transportation network at a city as follow:

- Construct a new highway in the network.
- Realignment of the old road ( Modifying the slopes, horizontal and vertical curves .....).
- Repair the old existing road.

The following table illustrates the cost and benefit of each alternate. Assuming that the project period is 10 years and the rate of annual depression is 8% and the rate of money investment in the banks is 11%.

- Find the best alternate in the following cases:

1. The project has unlimited budget of money.
2. Only 0.9 million L.E is available for the project.

Capital Cost (I)	Project (A) 1 Million L.E		Project (B) 0.9 Million L.E		Project (C) 0.5 Million L.E	
Year (I)	(B-C) L.E		(B-C) L.E		(B-C) L.E	
1	20000		50000		20000	
2	100000		150000		80000	
3	150000		250000		120000	
4	200000		300000		150000	
5	350000		340000		200000	
6	360000		300000		220000	
7	380000		220000		180000	
8	350000		150000		100000	
9	250000		100000		80000	
10	150000		5000		5000	