

50	60	70	25
60			

REG NO: 224001282 MEE

Vehicle density(x)	Travel speed(y)	\bar{x}	y_{t-1}	$x_t - \bar{x}$	$y_{t-1} - \bar{y}$	$(x_t - \bar{x})(y_{t-1} - \bar{y})$	x_t	y_{t-2}	$x_t - \bar{x}$	$y_{t-2} - \bar{y}$	$(x_t - \bar{x})(y_{t-2} - \bar{y})$	$(y_{t-2} - \bar{y})^2$
10	70	20	70	-15	15.333	-230	30	70	-5	15.333	-26.667	235.100
20	65	30	65	-5	10.333	-51.667	40	65	5	10.333	51.667	235.100
30	58	40	58	5	3.333	16.667	50	58	15	3.333	50	106.708
40	50	50	50	15	-4.667	-70	60	50	25	-4.667	-116.667	11.1088
50	45	60	45	25	-9.667	-241.667						11.1088
60	40											21.780
												21.780

-576.667

$$\hat{\gamma}_{xy}(k) = \frac{\sum_{t=1}^{n-k} (x_t - \bar{x})(y_{t+k} - \bar{y})}{\sqrt{\sum_{t=1}^n (x_t - \bar{x})^2 \cdot \sum_{t=1}^n (y_{t+k} - \bar{y})^2}}$$

$$\hat{\gamma}_{xy}(1) = \frac{-576.667}{\sqrt{1750 \times 683.33}} = -0.527$$

$$\hat{\gamma}_{xy}(2) = \frac{-91.667}{\sqrt{1750 \times 683.33}} = -0.0838$$

Interpretation:

- Both x and y show strong positive auto-correlation at lag 1, indicating that consecutive value are similar.
- Auto-correlation at lag 2 is much weaker for both variables.
- Negative cross-correlation at lag 1 (-0.527) indicates that as vehicle density increase, travel speed tend to decrease and at lag 2 is negligible (-0.0838).