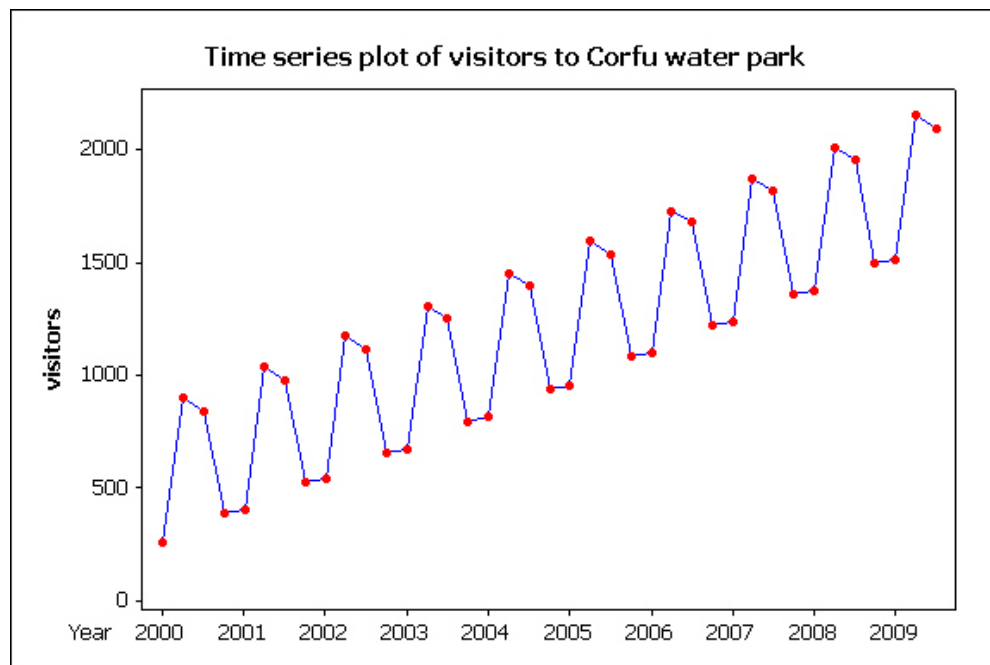


Exam-style question

The following time series plot shows the total number of visitors, each month, to a water park in a popular holiday resort on the island of Corfu. The holiday park is only open throughout the peak summer season, which runs from July – October (inclusive). Observations for the first three years are shown in the table below.



	July	August	September	October
2000	262	901	841	389
2001	402	1035	981	525
2002	541	1174	1117	658

- (a) The time series plot shows an overall positive trend in the number of visitors to the water park. What else does it show?
- (b) We can isolate the trend by calculating *centred moving averages*. Obtain the first **two** such moving averages for the water park dataset.
- (c) Let Y^* be the series of moving averages, and let T represent time, where t_i , $i = 1, 2, \dots$ corresponds to July 2000, August 2001, ... Then we have the following summaries:

$$\sum_{i=3}^{37} t_i = 700$$

$$\sum_{i=3}^{37} y_i = 42121.6$$

$$\sum_{i=3}^{37} t_i y_i^* = 966734$$

$$\sum_{i=3}^{37} t_i^2 = 17570$$

Using the summaries above, obtain the linear trend equation of the form

$$Y^* = \beta_0 + \beta_1 T + \varepsilon.$$

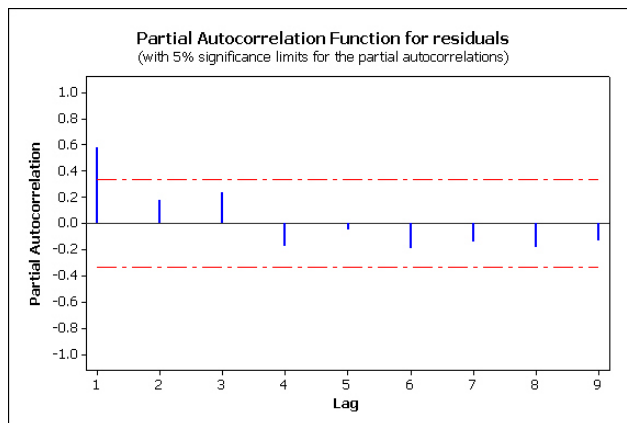
(d) The following output was obtained from Minitab.

Seasonal Indices

Period	Index
1	-282.078
2	317.734
3	227.797
4	-263.453

Explain what the **Seasonal Indices** actually are, and why we use them along with a trend equation to obtain *full forecasts*.

(e) After subtracting the trend and seasonal effects from the original data, Minitab was used to produce the following partial autocorrelation function for the residual series. Explain the link between this graph and the output to the right, and use the graph to approximate r_1 .



Final Estimates of Parameters

Type	Coef	SE Coef	T	P
AR 1	0.5820	0.1374	4.24	0.000
Constant	0.0513	0.3840	0.13	0.894
Mean	0.1228	0.9187		

Forecasts from period 39

95% Limits			
Period	Forecast	Lower	Upper
40	0.15618	-4.42292	4.73528
41	0.14221	-5.15592	5.44033
42	0.13407	-5.38639	5.65454

- (f) Using the output from Minitab above,
- write down the estimated model that has been fitted to the residuals;
 - forecast the number of visitors to the park in August 2010; *[For this, you will need to use the trend equation obtained in part (c) and the seasonal effects shown in part (d)]*
 - obtain a 95% confidence interval for your forecast in part (ii) above.

(i)