**MOUNT KENYA UNIVERSITY**

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS AND PHYSICS

**UNIVERSITY EXAMINATION FOR:**

BMA 3104: TIME SERIES

END OF SEMESTER EXAMINATION

**SERIES:** July – December 2017

**TIME:** 2 HOURS

**DATE:** December 2017

**Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of five questions. Attempt Question and any other two Questions.

**Do not write on the question paper.**

**Question ONE (30marks)**

1.  using backward shift operator determine whether the following processes are invertible  (5marks)
2. Let , is this process stationary? (3marks)
3. Using the table below Calculate the seasonality indices using the simple average method (5 marks)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Quarter | | | | |
| Year | 1 | 2 | 3 | 4 |
| 1970 | 30 | 40 | 36 | 34 |
| 1971 | 34 | 52 | 50 | 44 |
| 1972 | 40 | 58 | 54 | 48 |
| 1973 | 44 | 76 | 68 | 62 |

1. State the importance of analyzing time series containing seasonal variation (3marks)
2. Using the data below compute a moving average of order of five (5 marks)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year (t) | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
| Sales () | 930 | 1028 | 1267 | 1035 | 1057 | 1332 | 1567 | 1757 | 1616 |

1. Consider the exponential curve reduce the series into linear hence obtain the estimator for b. (5marks)
2. State the objectives of time series analysis (4marks)

**Question TWO (20marks)**

The table below gives the numbers of deep freezers sold by Brian Appliances

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Quarter | | | | |
| Year | 1 | 2 | 3 | 4 |
| 1977 | 28 | 30 | 22 | 24 |
| 1978 | 20 | 30 | 28 | 44 |
| 1979 | 34 | 46 | 44 | 62 |
| 1980 | 40 | 46 | 36 | 52 |
| 1981 | 40 | 54 | 30 | 72 |

1. Obtain the trend values by the least squares method (10 marks)
2. Eliminate the cyclic and irregular components (5 marks)
3. Obtain the adjusted seasonal index (5 marks)

**Question THREE (20marks)**

1. Consider the case where 

show that

 (13marks)

1. Consider the series

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 8 | 27 | 64 | 125 | 216 | 343 | 512 | 729 |
| t | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Compute the trend value at using the model in part (i) above (7 marks)

**Question FOUR (20marks)**

1. Suppose show that  is not stationary but  is stationary. (8marks)
2. Consider process , show that the  converges to an infinite moving average of random elements with weights  (12marks)

**Question FIVE (20mars)**

The table below gives the freight ton-miles carried by a railroad for the period 1971-1981

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year (t) | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
| Freight ton-miles () | 93 | 91 | 96 | 89 | 90 | 82 | 88 | 86 | 87 | 94 | 92 |

1. Fit a straight line by method of least squares (7 marks)
2. Tabulate the trend values (4 marks)
3. What components of the time series are thus left (3marks)
4. What is the monthly increase in the sales (3 marks)
5. Estimate the sales in 1982 (3 marks)