MONASH University

MONASH BUSINESS SCHOOL

ETC3550/ETC5550 Applied forecasting

Week 1

`af.numbat.space`

Contact details

Chief Examiner: Professor Rob Hyndman

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Tutors

- **Mitchell O'Hara-Wild**
- Elena Sanina
- Xiaoqian Wang
- Zhixiang (Elvis) Yang

Brief bio

- Professor of Statistics, Monash University
- Co-author of most popular forecasting textbook in the world
- Developer of most popular forecasting software in the world

How my forecasting methodology is used:

- Pharmaceutical Benefits Scheme
- Electricity demand
- Australian tourism demand
- Ageing population
- COVID-19 cases
- TAC large claims

Unit objectives

1. To obtain an understanding of common statistical methods used in business and economic forecasting.
2. To develop the computer skills required to forecast business and economic time series data;
3. To gain insights into the problems of implementing and operating large scale forecasting systems for use in business.

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Teaching and learning approach

- Approximately one hour of online videos each week.
- One 90 minute in-person tutorial each week.
- One 50 minute in-person seminar each Friday.
- One tutorial will be recorded each week and posted online.

Key reference

Hyndman, R. J. & Athanasopoulos, G. (2021) *Forecasting: principles and practice*, 3rd edition

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OTexts.com/fpp3/

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- Free and online
- Data sets in associated R packages
- R code for examples
- Embedded online lectures

Outline

Week	Topic	Chapter
1	Introduction to forecasting and R	1
2	Time series graphics	2
3	Time series decomposition	3
4	The forecaster’s toolbox	5
5–6	Exponential smoothing	8
7–9	ARIMA models	9
10	Multiple regression and forecasting	7
11–12	Dynamic regression	10

Assessment

- Four assignments and one larger project: 40%
- Exam (2 hours): 60%.

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Task	Due Date	Value
Assignment 1	Fri 8 Mar	2%
Assignment 2	Fri 22 Mar	6%
Assignment 3	Fri 12 Apr	6%
Assignment 4	Fri 3 May	6%
Retail Project	Fri 24 May	20%
Final Exam	Official exam period	60%

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- Need at least 45% for exam, and 50% for total.
- **ETC5550 students:** Extra exam question.

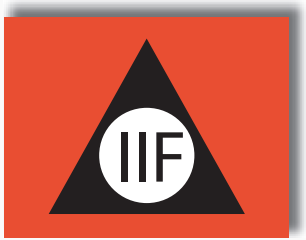
Unit website

af.numbat.space

- Includes all course materials
- Links for assignment submissions
- Link to discussion forum.

Please don’t send emails. Use the forum.

International Institute of Forecasters



- The IIF provides a prize to the top student in this subject each year.
- US$100 plus one year membership.

R

Available for download from CRAN:

https://cran.r-project.org

Available for download from RStudio:

https://www.rstudio.com/products/rstudio/download/

Main packages

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```
# Install required packages (do once)
install.packages(c("tidyverse", "fpp3", "GGally), dependencies = TRUE)
```

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install.packages(c("tidyverse", "fpp3", "GGally), dependencies = TRUE)
```

```
# At the start of each session
library(fpp3)
```

Exercises Week 1

- Make sure you are familiar with R, RStudio and the tidyverse packages.
- Do first five chapters of `learnr.numbat.space`.
- Assignment 1

Assignment 1: forecast the following series

1. Google closing stock price on 20 March 2024
2. Maximum temperature at Melbourne airport on 10 April 2024
3. The difference in points (Collingwood minus Essendon) scored in the AFL match between Collingwood and Essendon for the Anzac Day clash. 25 April 2024
4. The seasonally adjusted estimate of total employment for April 2024. ABS CAT 6202, to be released around mid May 2024
5. Google closing stock price on 22 May 2024

Due Friday 8 March

For each of these, give a point forecast and an 80% prediction interval.

Assignment 1: forecast the following series

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2. Maximum temperature at Melbourne airport on 10 April 2024
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Prize: $50 cash prize

Assignment 1: scoring

Y = actual, F = point forecast, $[L, U]$ = prediction interval

Point forecasts:

$$\text{Absolute Error} = |Y - F|$$

- Rank results for all students in class
- Add ranks across all five items

Prediction intervals:

$$\text{Interval Score} = (U - L) + 10(L - Y)_+ + 10(Y - U)_+$$

- $u_+ = \max(u, 0)$
- Rank results for all students
- Add ranks across all five items

tsibble objects

```
global_economy
```

```
# A tsibble: 15,150 x 6 [1Y]
# Key:       Country [263]
    Year Country              GDP Imports Exports Population
   <dbl> <fct>              <dbl>   <dbl>   <dbl>      <dbl>
 1  1960 Afghanistan  537777811.    7.02    4.13    8996351
 2  1961 Afghanistan  548888896.    8.10    4.45    9166764
 3  1962 Afghanistan  546666678.    9.35    4.88    9345868
 4  1963 Afghanistan  751111191.   16.9     9.17    9533954
 5  1964 Afghanistan  800000044.   18.1     8.89    9731361
 6  1965 Afghanistan 1006666638.   21.4    11.3     9938414
 7  1966 Afghanistan 1399999967.   18.6     8.57   10152331
 8  1967 Afghanistan 1673333418.   14.2     6.77   10372630
 9  1968 Afghanistan 1373333367.   15.2     8.90   10604346
10  1969 Afghanistan 1408888922.   15.0    10.1    10854428
# i 15,140 more rows
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Index | Key | Measured variables

tsibble objects

```
tourism
```

```
# A tsibble: 24,320 x 5 [1Q]
# Key:       Region, State, Purpose [304]
   Quarter Region   State Purpose  Trips
     <qtr> <chr>    <chr> <chr>    <dbl>
 1 1998 Q1 Adelaide SA    Business  135.
 2 1998 Q2 Adelaide SA    Business  110.
 3 1998 Q3 Adelaide SA    Business  166.
 4 1998 Q4 Adelaide SA    Business  127.
 5 1999 Q1 Adelaide SA    Business  137.
 6 1999 Q2 Adelaide SA    Business  200.
 7 1999 Q3 Adelaide SA    Business  169.
 8 1999 Q4 Adelaide SA    Business  134.
 9 2000 Q1 Adelaide SA    Business  154.
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# i 24,310 more rows
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Domestic visitor nights in thousands by state/region and purpose.

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Domestic visitor nights in thousands by state/region and purpose.

`tsibble` objects

- A `tsibble` allows storage and manipulation of multiple time series in R.
- It contains:
  - An index: time information about the observation
  - Measured variable(s): numbers of interest
  - Key variable(s): optional unique identifiers for each series
- It works with tidyverse functions.

The `tsibble` index

Time index variables can be created with these functions:

Frequency	Function
Annual	`start:end`
Quarterly	`yearquarter()`
Monthly	`yearmonth()`
Weekly	`yearweek()`
Daily	`as_date()`, `ymd()`
Sub-daily	`as_datetime()`

Your turn

1. Download `tourism.xlsx` from `http://robjhyndman.com/data/tourism.xlsx`, and read it into R using `read_excel()` from the `readxl` package.
2. Create a tsibble which is identical to the `tourism` tsibble from the `tsibble` package.
3. Find what combination of `Region` and `Purpose` had the maximum number of overnight trips on average.
4. Create a new tsibble which combines the Purposes and Regions, and just has total trips by State.