M250 Overview

M250 Prsntn 2025J Overview

Phil Molyneux

12 October 2025

M250 Overview Tutorial

Agenda

- Introductions
- *Adobe Connect* — if you or I get cut off, wait till we reconnect (or send you an email)
- M250 overview
- Software resources & learning software packages
- Data types & variables
- Some useful Web & other references
- Time: about 1 hour
- Do ask questions or raise points.
- Slides/Notes M250Tutorial20251012OverviewPrsntn2025J

M250 Tutorial

Introductions — Phil

- *Name* Phil Molyneux
- *Background*
  - Undergraduate: Physics and Maths (Sussex)
  - Postgraduate: Physics (Sussex), Operational Research (Brunel), Computer Science (University College, London)
  - Worked in Operational Research, Business IT, Web technologies, Functional Programming
- *First programming languages* Fortran, BASIC, Pascal
- *Favourite Software*
  - Haskell — pure functional programming language
  - Text editors TextMate, Sublime Text — previously Emacs
  - Word processing in LaTeX — all these slides and notes
  - Mac OS X
- *Learning style* — I read the manual before using the software

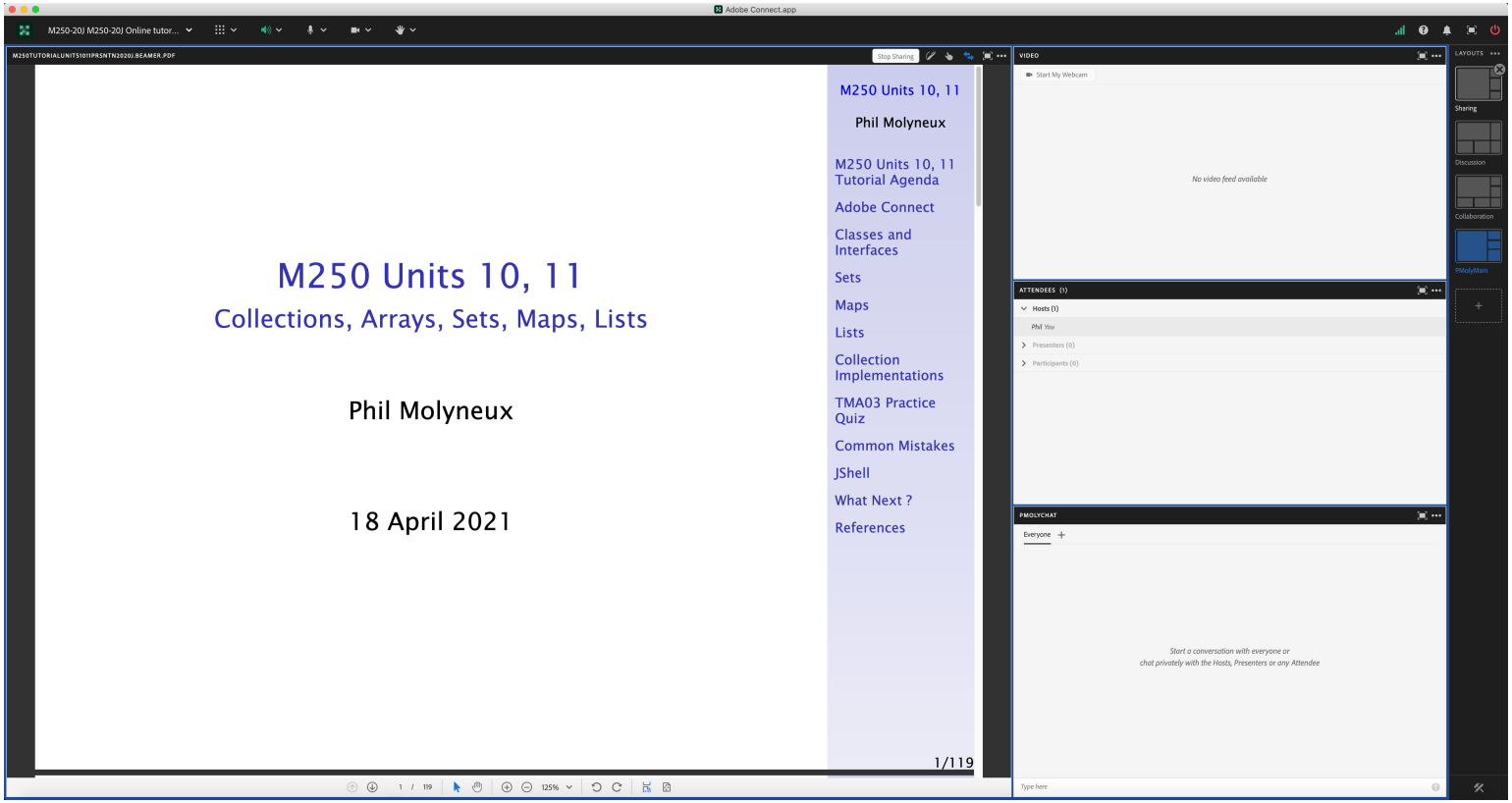
M250 Tutorial

Introductions — You

- *Name ?*
- *Favourite software/Programming language ?*
- *Favourite text editor or integrated development environment (IDE)*
- List of text editors, Comparison of text editors and Comparison of integrated development environments
- *Other OU courses ?*
- *Anything else ?*

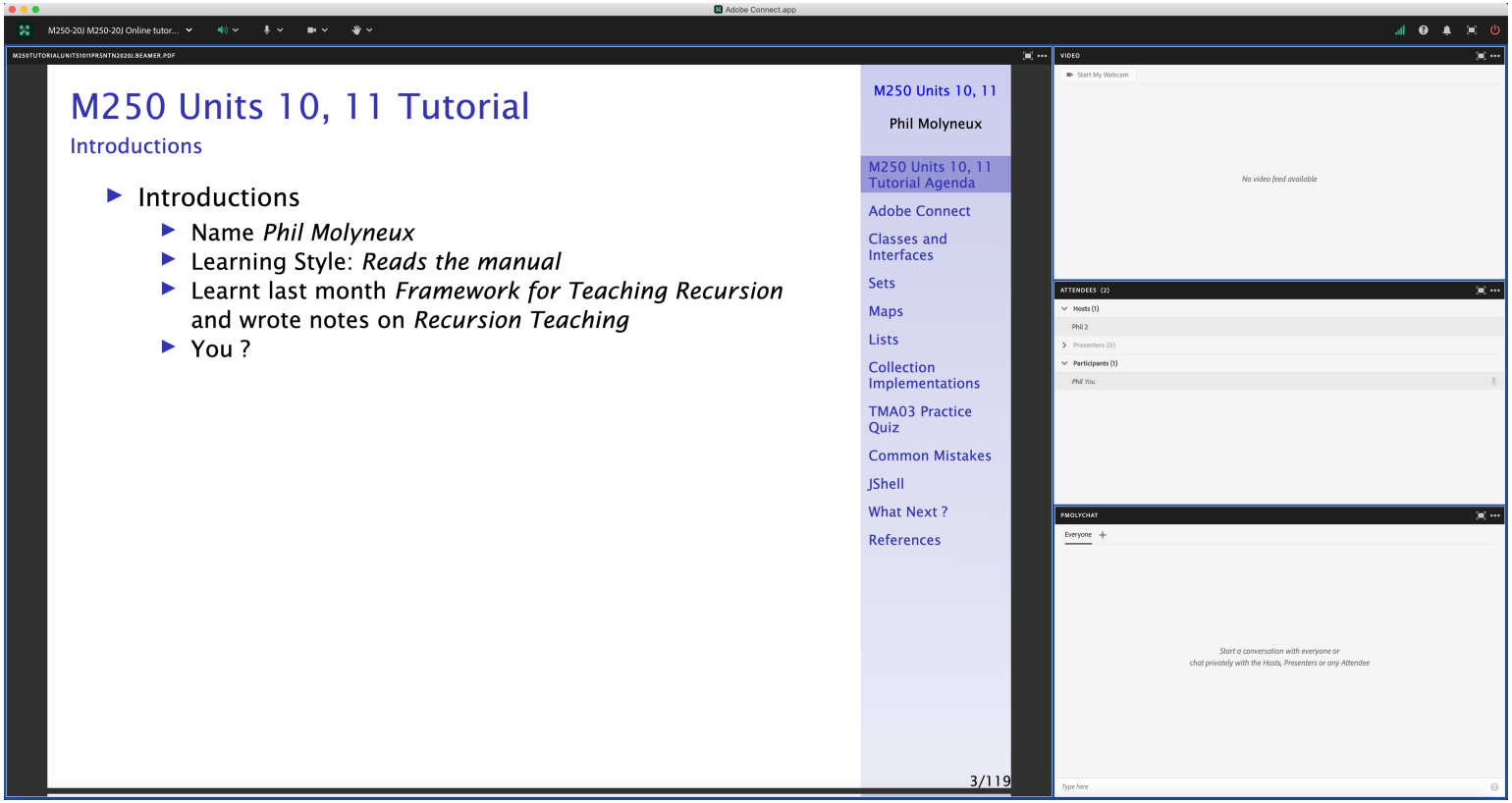
Adobe Connect

Interface — Host View



Adobe Connect

Interface — Participant View



Adobe Connect

Settings

- **Everybody** *Menu bar* › *Meeting* › Speaker & Microphone Setup
- *Menu bar* › *Microphone* › Allow Participants to Use Microphone ✔
- Check Participants see the entire slide **Workaround**
  - *Disable Draw* *Share pod* › *Menu bar* › *Draw icon*
  - *Fit Width* *Share pod* › *Bottom bar* › *Fit Width icon* ✔
- *Meeting* › Preferences › General › **Host Cursor** › Show to all attendees
- *Menu bar* › *Video* › Enable **Webcam** for Participants ✔
- Do not *Enable single speaker mode*
- Cancel hand tool
- Do not enable green pointer
- **Recording** Meeting › Record Session ✔
- **Documents** Upload PDF with drag and drop to share pod
- Delete *Meeting* › Manage Meeting Information › Uploaded Content and *check filename* › *click on delete*

Adobe Connect

Access

- **Tutor Access**

  TutorHome > M269 Website > Tutorials

  Cluster Tutorials > M269 Online tutorial room

  Tutor Groups > M269 Online tutor group room

  Module-wide Tutorials > M269 Online module-wide room

- **Attendance**

  TutorHome > Students > View your tutorial timetables

- **Beamer Slide Scaling** 440% (422 x 563 mm)

- **Clear Everyone's Status**

  Attendee Pod > Menu > Clear Everyone's Status

- **Grant Access** and send link via email

  Meeting > Manage Access & Entry > Invite Participants...

- **Presenter Only Area**

  Meeting > Enable/Disable Presenter Only Area

Adobe Connect

Keystroke Shortcuts

- Keyboard shortcuts in Adobe Connect
- **Toggle Mic** ⌘ + M (Mac), Ctrl + M (Win) (On/Disconnect)
- **Toggle Raise-Hand status** ⌘ + E
- **Close dialog box** ⎋ (Mac), Esc (Win)
- **End meeting** ⌘ + \

Adobe Connect Interface

Sharing Screen & Applications

- Share My Screen > Application tab > Terminal for Terminal
- Share menu > Change View > Zoom in for mismatch of screen size/resolution (Participants)
- (Presenter) Change to 75% and back to 100% (solves participants with smaller screen image overlap)
- Leave the application on the original display
- Beware blued hatched rectangles — from other (hidden) windows or contextual menus
- Presenter screen pointer affects viewer display — beware of moving the pointer away from the application
- First time: System Preferences > Security & Privacy > Privacy > Accessibility

Adobe Connect

Ending a Meeting

- *Notes for the tutor only*
- **Student:** Meeting > Exit Adobe Connect
- **Tutor:**
- **Recording** Meeting > Stop Recording ✔
- **Remove Participants** Meeting > End Meeting... ✔
  - Dialog box allows for message with default message:
  - *The host has ended this meeting. Thank you for attending.*
- **Recording availability** *In course Web site for joining the room, click on the eye icon in the list of recordings under your recording* — edit description and name
- **Meeting Information** Meeting > Manage Meeting Information — can access a range of information in Web page.
- **Delete File Upload** Meeting > Manage Meeting Information > Uploaded Content tab select file(s) and click Delete
- **Attendance Report** see course Web site for joining room

Adobe Connect

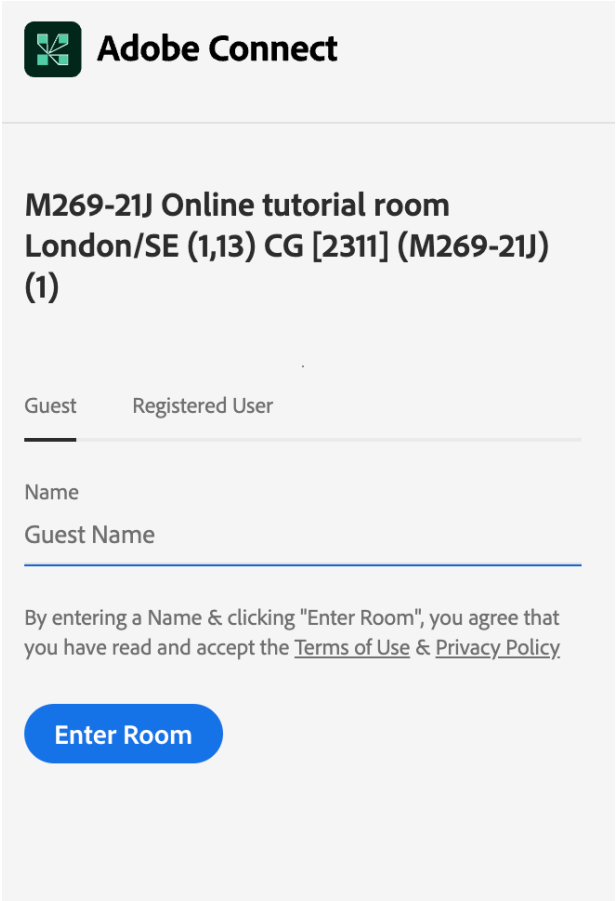
Invite Attendees

- **Provide Meeting URL** Menu > Meeting > Manage Access & Entry > Invite Participants...
- **Allow Access without Dialog** Menu > Meeting > Manage Meeting Information provides new browser window with *Meeting Information* Tab bar > Edit Information
- Check *Anyone who has the URL for the meeting can enter the room*
- Default *Only registered users and accepted guests may enter the room*
- **Reverts to default next session but URL is fixed**
- Guests have blue icon top, registered participants have yellow icon top — same icon if URL is open
- See Start, attend, and manage Adobe Connect meetings and sessions

Adobe Connect

Entering a Room as a Guest (1)

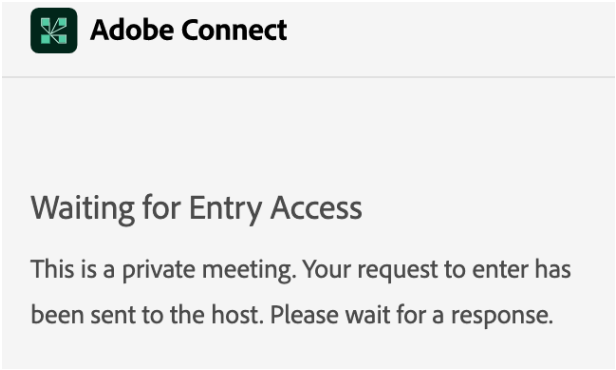
- Click on the link sent in email from the Host
- Get the following on a Web page
- As *Guest* enter your name and click on Enter Room



Adobe Connect

Entering a Room as a Guest (2)

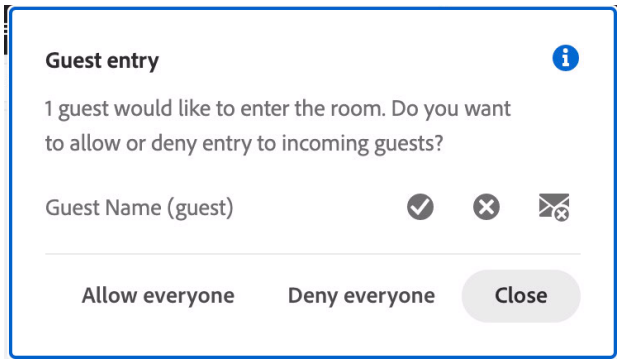
- See the *Waiting for Entry Access* for *Host* to give permission



Adobe Connect

Entering a Room as a Guest (3)

- *Host* sees the following dialog in *Adobe Connect* and grants access



Adobe Connect

Layouts

- **Creating new layouts** example *Sharing* layout
- Menu > Layouts > Create New Layout... > Create a New Layout dialog > Create a new blank layout and name it *PMolyMain*
- New layout has no Pods but does have Layouts Bar open (see Layouts menu)
- **Pods**
- Menu > Pods > Share > Add New Share and resize/position — initial name is *Share n* — rename *PMolyShare*
- **Rename Pod** Menu > Pods > Manage Pods... > Manage Pods > Select > Rename or Double-click & rename
- Add Video pod and resize/reposition
- Add Attendance pod and resize/reposition
- Add Chat pod — rename it *PMolyChat* — and resize/reposition

Adobe Connect

Layouts

- Dimensions of **Sharing** layout (on 27-inch iMac)
  - Width of Video, Attendees, Chat column 14 cm
  - Height of Video pod 9 cm
  - Height of Attendees pod 12 cm
  - Height of Chat pod 8 cm
- **Duplicating Layouts** does *not* give new instances of the Pods and is probably not a good idea (apart from local use to avoid delay in reloading Pods)
- **Auxiliary Layouts** name *PMolyAux0n*
  - Create new Share pod
  - Use existing Chat pod
  - Use same Video and Attendance pods

Adobe Connect

Chat Pods

- **Format Chat text**
- Chat Pod > menu icon > My Chat Color
- Choices: Red, Orange, Green, Brown, Purple, Pink, Blue, Black
- Note: Color reverts to Black if you switch layouts
- Chat Pod > menu icon > Show Timestamps

Graphics Conversion

PDF to PNG/JPG

- Conversion of the screen snaps for the installation of Anaconda on 1 May 2020
- Using GraphicConverter 11
- File > Convert & Modify > Conversion > Convert
- Select files to convert and destination folder
- Click on Start selected Function or ⌘ + ⏎

Adobe Connect Recordings

Exporting Recordings

- *Menu bar* > *Meeting* > Preferences > Video
- Aspect ratio > Standard (4:3) (not Wide screen (16:9) default)
- Video quality > Full HD (1080p not High default 480p)
- **Recording** *Menu bar* > *Meeting* > Record Session ✔
- **Export Recording**
- *Menu bar* > *Meeting* > Manage Meeting Information
- *New window* > Recordings > *check Tutorial* > Access Type button
- check Public > check Allow viewers to download
- **Download Recording**
- *New window* > Recordings > *check Tutorial* > Actions > Download File

M250 Overview

Module Aims and Structure

- Object-oriented programming
- Encapsulation enforces modularity — implementations of objects not available outside some *container*
- Inheritance encourages reuse of code and organises complexity
- Polymorphism enables a structured approach to different objects responding differently to the same messages
- Java is a class-based, object-oriented general-purpose programming language with strong type system
- Type system addresses the problem of ensuring that programs have meaning — we shall look at this later but consider

  1 + 2 and 1 + '2' are they valid ?
- We are using Java to illustrate an object-oriented approach to programming
- We will not have complete coverage of every feature of Java

M250 Overview

Expression Quiz

- Evaluate `1 + 2`

```
jshell> 1 + 2
$1 ==> 3
```

- Evaluate `1 + '2'`

```
jshell> 1 + '2'
$2 ==> 51
```

- The evaluations are using JShell a Read-Eval-Print Loop (REPL) tool for exploring Java
- What is going on here? A character is a *numeric* type

```
jshell> (int) '2'
$3 ==> 50
jshell> (char) 50
$4 ==> '2'
```

- The above are explicit *type conversions*

M250 Overview

Expression Quiz (2)

- Beware mixing characters and strings

```
jshell> '1' + '2'
$5 ==> 99

jshell> "1" + "2"
$6 ==> "12"
```

- The former does implicit type casting to `int`
- The latter is string concatenation
- The (+) operator is *overloaded*

M250 Overview

Chps 1 to 4

- Chp 1: Objects and classes
- Chp 2: Understanding class definitions
- Chp 3: Object interactions
- Chp 4: Grouping objects
- Chp 5: Functional processing of collections

M250 Overview

Chps 6 and 7

- Chp 6: More sophisticated behaviour
- Chp 7: Fixed-size collections — arrays
- Programming outside BlueJ

M250 Overview

Chps 9 to 12, and 14

- Chp 8: Designing classes and code conventions
- Chp 9: Well-behaved object and debugging
- Chp 10: Improving structure with inheritance
- Chp 11: More about inheritance
- Chp 12: Further abstraction techniques — Interfaces
- Chp 14: Handling errors

M250 Overview

M250 Resources

- Module Guide (online)
- Software Guide (online)
- M250 BlueJ Activities
- M250 Java Reference
- Chapter companions — reading guides
- Exam Handbook (print/online under Assessment)
- Study calendar (HTML/PDF)
- Programming outside BlueJ (optional) (online)

M250 Resources

M250 Exam Handbook

M250-21J Object-oriented Java programming

The Open University

M250 Java Reference

This item contains selected online content. It is for use alongside, not as a replacement for the module website, which is the primary study format and contains activities and resources that cannot be replicated in the printed versions.

Contents

M250 Overview

M250 Chapter Companions — Extra Teaching

- Key areas going beyond the textbook:
- **Chp 1 Prequel** VMs; Java history; procedural/OO programming
- **Chp 3** Additional discussion on calling methods and bounding boxes of graphical objects
- **Chp 6** Iterating over a map; maps with sets as values
- **Chp 7** Arrays holding references to objects
- **Programming outside BlueJ** supplement
- **Chp 8** M250 Code conventions and design
- **Chp 9** More on static and dynamic code; different kinds of errors, debugging; formatted printing (printf)
- **Chp 10** Inheritance; constructors; members
- **Chp 11** More on hash codes, equals, and `Objects.hash` method; `getClass` compared to `instanceof`; immutability of keys
- **Chp 12** The `Comparable` interface

M250 Overview

M250 Assessment from 2021J

- 3 TMAs
  - TMA01 15% Chps 1 to 4
  - TMA02 15% Chps 6 and 7
  - TMA03 20% Chps 9 to 12, and 14
  - Exam 50%
- Final exam in June
- To pass, must achieve at least 40% in both OCAS (Overall Continuous Assessment Score) and 30% OES (Overall Examinable Score)

Object Concepts

Sample Code (1)

- From M250 version to 2020J Unit 2
- Example code 1

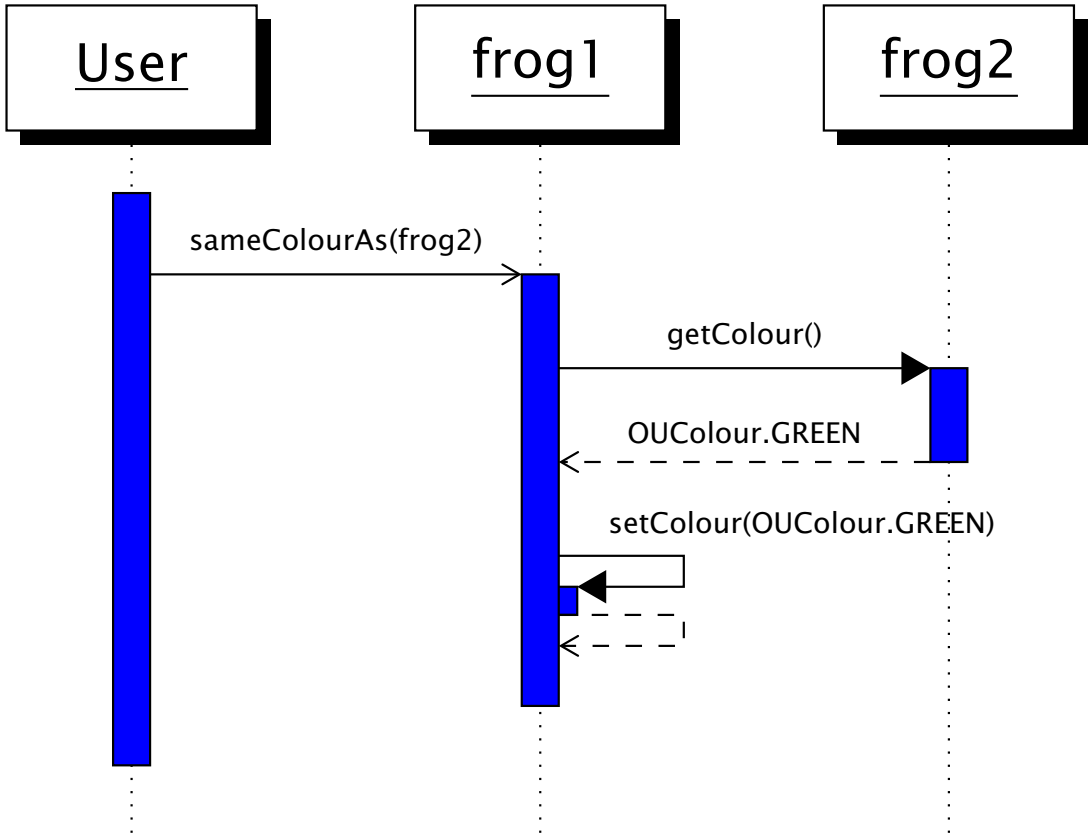
```
public void sameColourAs (Frog aFrog) {
   this.setColour(aFrog.getColour()) ;
}
```

```
jshell> frog1.sameColourAs(frog2)
```

- The JShell prompt is just indicative of code usage — usually would be graphical interface here

Unit 2: Object Concepts

Sequence Diagrams



- The diagrams are similar to the UML (Unified Modelling Language) diagrams
- See also Unified Modelling Language
- See Unit 2 Section 5.3 *Collaborating objects*, page 67

Object Concepts

Sample Code (2)

- From M250 version to 2020J Unit 2
- Example code (2)

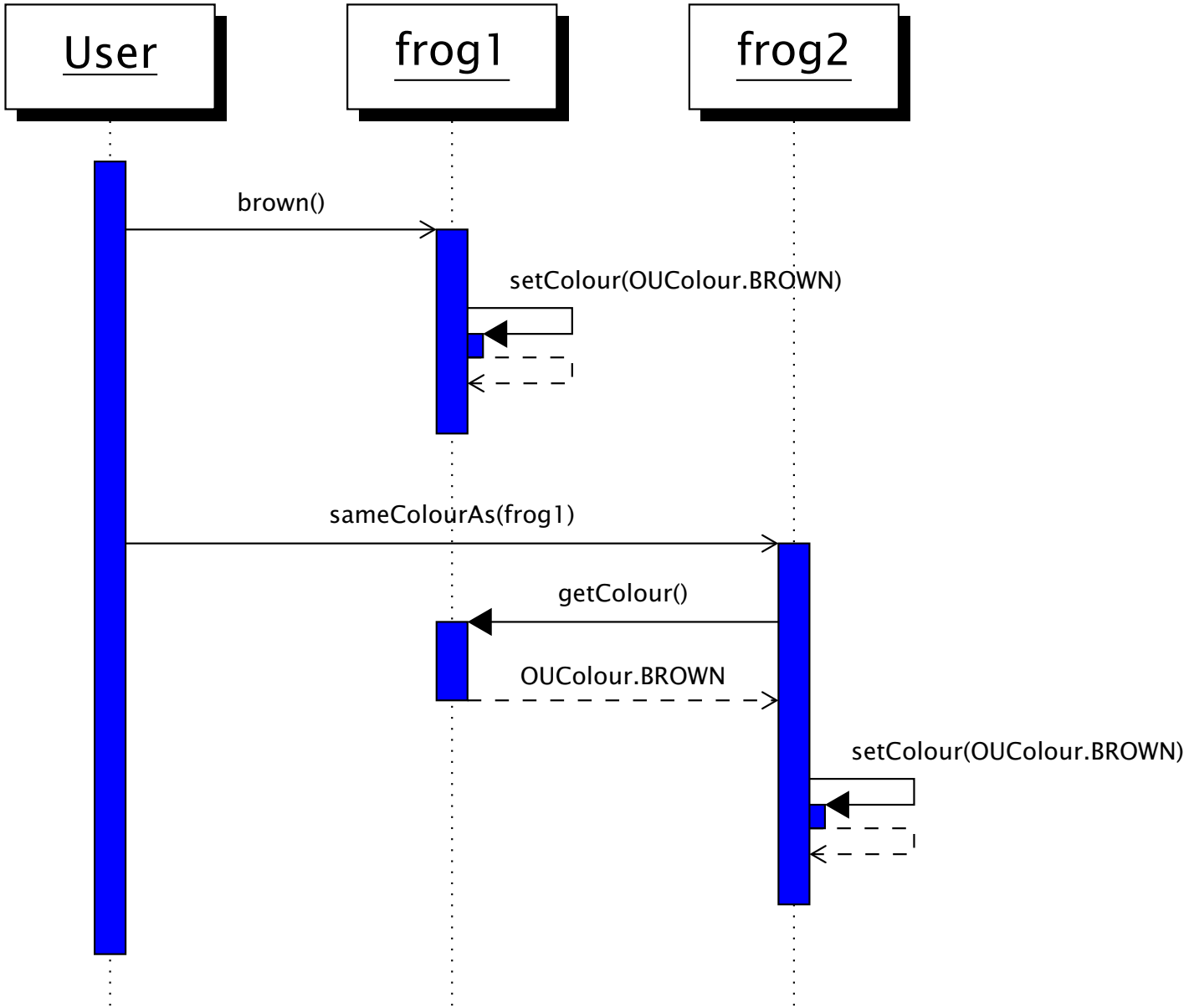
```
public void sameColourAs (Frog aFrog) {
   this.setColour(aFrog.getColour()) ;
}

public void brown()  {
   this.setColour(OUColour.BROWN) ;
}
```

```
jshell> frog1.brown()
jshell> frog2.sameColourAs(frog1)
```

Unit 2: Object Concepts

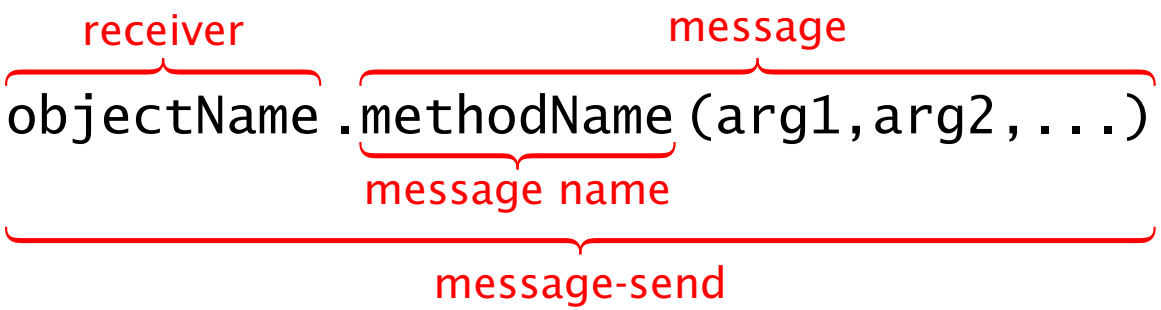
Sequence Diagrams (2)



Messages and Methods

Computation Model

- Object-oriented view: programs work using *objects* which communicate by sending *messages*



- Objects have *state* (implemented by *attributes*) and *behaviour*, its response to messages (implemented by the *protocol*: methods implementing messages)
- A message must correspond to the signature of one of the methods in the protocol
- Object terminology is in *M250 Glossary* — this is an object-oriented view of programs
- Note: the terminology is not standard across all texts — see, for example, Glossary of Java and Related Terms from Barnes (2000) (author of BlueJ texts)

BlueJ

Installing & Using BlueJ — 2020J and before

- M250 Website › Resources › Software resources and follow the instructions
- Note: macOS users will have to disable *Gatekeeper* see Disable Gatekeeper — in Terminal say:

```
sudo spctl --master-disable
```

- On launch, BlueJ looks for **bluej.defs** for its settings — in macOS this should be at ~/M250/BlueJ/BlueJ.app/Contents/Resources/Java/bluej.defs
- You can have spaces in file or folder names but that will make life painful, so don't
- See discussion forums for various problems and how to solve them

BlueJ

Installing & Using BlueJ — 2021J and later

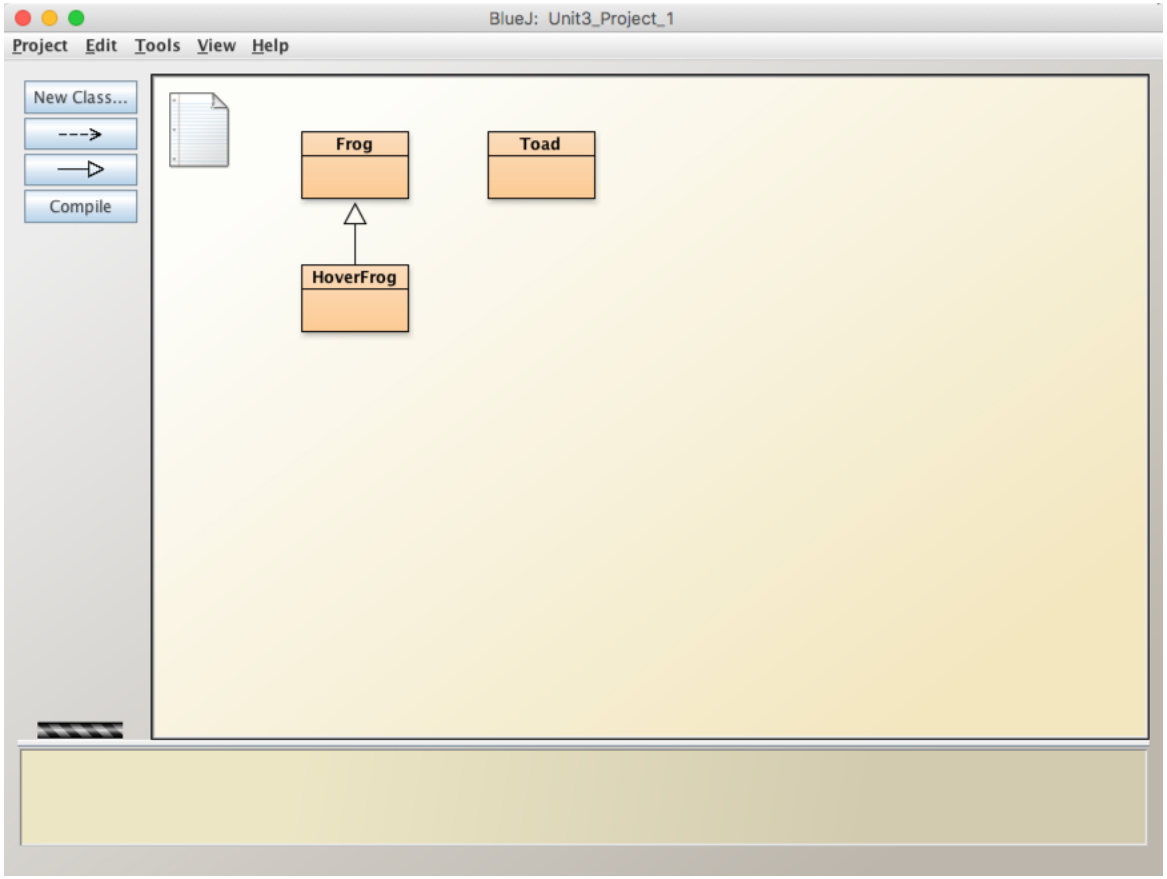
- M250 Website › Resources › Software resources and follow the instructions
- Note: macOS users will have to disable *Gatekeeper* see Disable Gatekeeper — in Terminal say:

```
sudo spctl --master-disable
```

- Install BlueJ version 4.1.4 from BlueJ Version History — (27 September 2021) site down!!
- You can have spaces in file or folder names but that will make life painful, so don't
- See discussion forums for various problems and how to solve them

BlueJ

BlueJ Interface



- BlueJ window for Unit 3 Project 1
- Name the parts ?

BlueJ

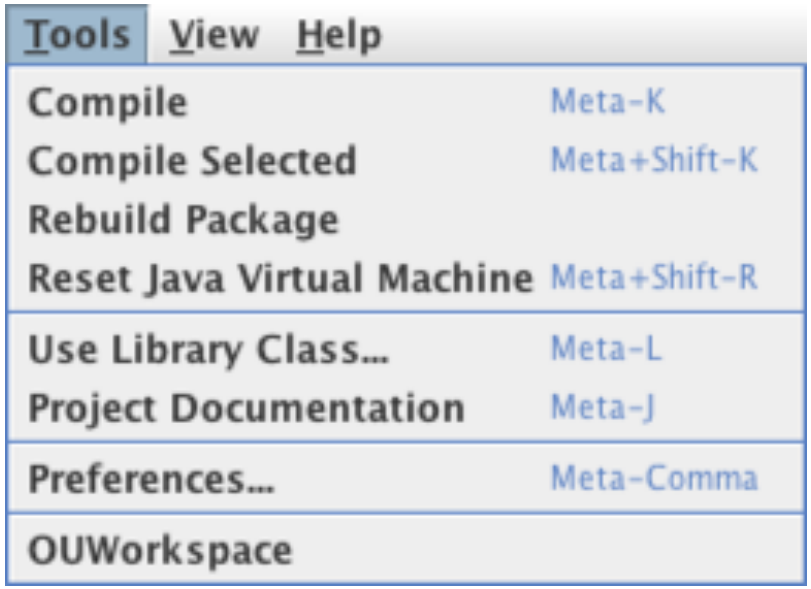
BlueJ Interface: Project Menu

BlueJ

BlueJ Interface: Edit Menu

BlueJ

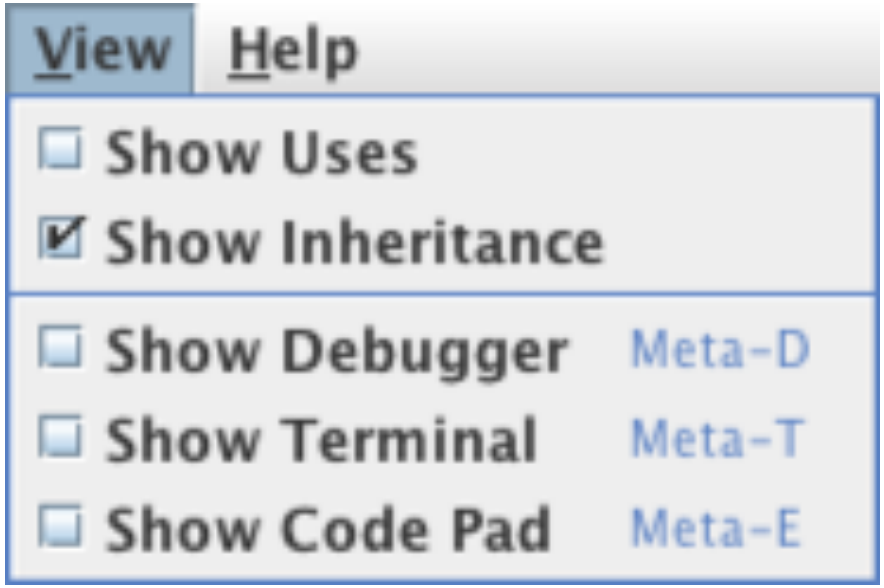
BlueJ Interface: Tools Menu



- Note the **OUWorkspace**

BlueJ

BlueJ Interface: View Menu



- The **Code Pad** takes part of the **Object Bench**

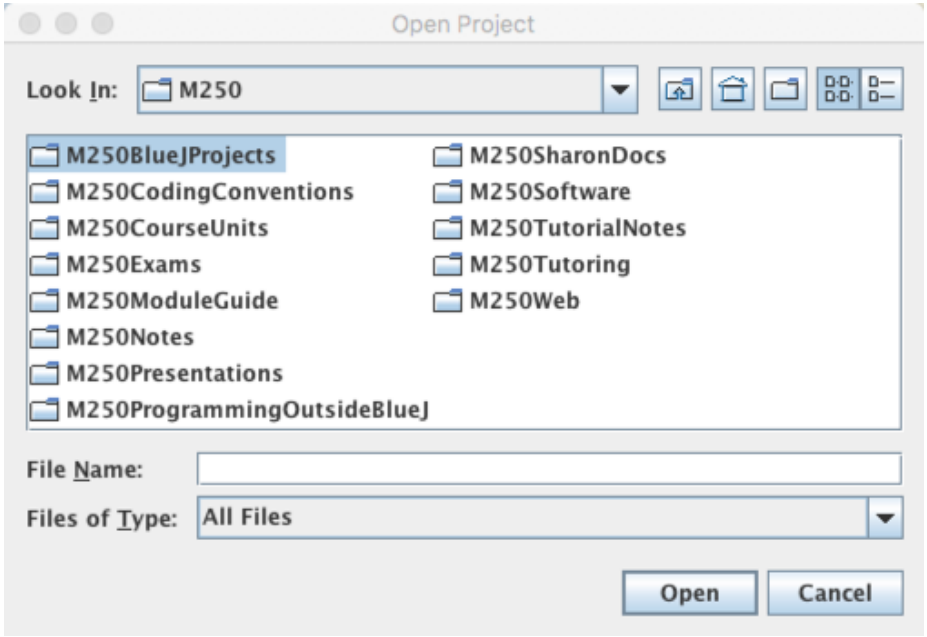
BlueJ

BlueJ Interface: Help Menu

- The **OU Class Library** will try to launch a Web browser
- The documentation is in oudocs *near* the BlueJ app
- In Phil's case: (but yours will be somewhere else)
- `file:///Users/molyneux/MyData/Documents/OU/Courses/Computing/M250/M250Software/M250Working/oudocs/index.html`

BlueJ

BlueJ Projects



- **Open a project**
- To navigate into a folder
- Select `folder` and
- Double-click (Windows) or Return ⏎ or
- Enter ⌅ (Mac)
- Return ⏎ (Mac) means Open
- **New Project**
- Return ⏎ or Enter ⌅ (Mac) both mean `Create` (which is wrong)

Learning Software Packages

Key questions

1. Where is the package source ?
2. What version are you using ?
3. What documentation is available ?
4. What are the *names* for the parts of the interface ?
5. How do you leave the package ? How do you enter the package ?
6. Is there any on-line help and, if so, how is it used ?
7. Are there any initialisation files, configuration or preferences and how are they used ?
8. How do you import and export data from the package ?
9. *When all else fails,* how can you obtain advice ?

BlueJ — Exercise

Key Questions (1)

- Answer the *Key Questions* for BlueJ
- Where is the package source ?
- What version are you using ?

BlueJ — Exercise

Key Questions (1a)

- Where is the package source ?

  BlueJ BlueJ Web site
- What version are you using ?

  4.1.4
- What version of Java SDK does that use ?

  Java 8

BlueJ — Exercise

Key Questions (2)

- Answer the *Key Questions* for BlueJ
- What documentation is available ?

BlueJ — Exercise

Key Questions (2a)

- Answer the *Key Questions* for BlueJ
- What documentation is available ?
- What Java documentation is available ?

  Java Documentation

  JDK 17 Documentation

  Java Platform, Standard Edition Documentation — see the documentation for JDK 8
- Which was the first version to have JShell ?

  Java 9

BlueJ — Exercise

Key Questions (3)

- Answer the *Key Questions* for BlueJ
- What are the *names* for the parts of the interface ?

BlueJ — Exercise

Key Questions (3a)

- Answer the *Key Questions* for BlueJ
- What are the *names* for the parts of the interface ?

  See diagram in BlueJ documentation

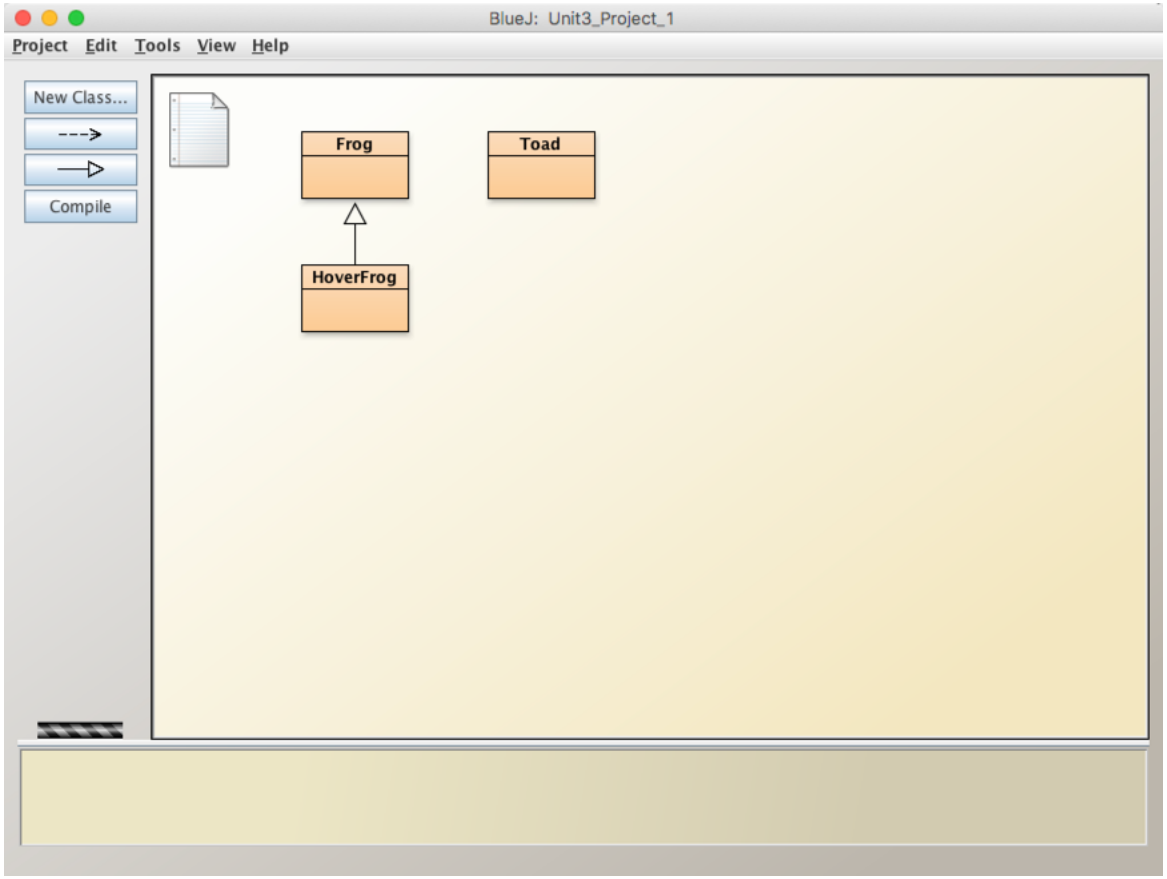
  Main window

  Object bench
- Where is the *Code Pad* ?
- How do you create new objects or inspect existing ones ?
- How do you execute methods of an object ?
- How do you edit the source code of a class ?

BlueJ — Exercise

Key Questions (3b)

- Answer the *Key Questions* for BlueJ
- What are the *names* for the parts of the interface ?



BlueJ — Exercise

Key Questions (3a)

- Answer the *Key Questions* for BlueJ
- What are the *names* for the parts of the interface ?

  See diagram in BlueJ documentation

  Main window

  Object bench
- Where is the *Code Pad* ? View > Show Code Pad
- How do you create new objects or inspect existing ones ? *Right-Click on Class* in main window
- How do you execute methods of an object ? *Right-Click on Object* in Object bench
- How do you edit the source code of a class ? *Right-Click on Class* and Open Editor

BlueJ — Exercise

Key Questions (4)

- Answer the *Key Questions* for BlueJ
- How do you leave the package ? How do you enter the package ?

BlueJ — Exercise

Key Questions (4a)

- Answer the *Key Questions* for BlueJ
- How do you leave the package ? How do you enter the package ?
- **Enter**
- Load a project Project > Open Project...
- How do you use a project from the command line with JShell ?
- **Leave**

BlueJ — Exercise

Key Questions (5)

- Answer the *Key Questions* for BlueJ
- Is there any on-line help and, if so, how is it used ?

BlueJ — Exercise

Key Questions (5a)

- Answer the *Key Questions* for BlueJ
- Is there any on-line help and, if so, how is it used ?

  Help > BlueJ Tutorial

  Help > BlueJ Web Site

  Tools > Project Documentation

  Kelp > Java Class Libraries to view Java API Specification

  but you will have to read the documentation

BlueJ — Exercise

Key Questions (6)

- Answer the *Key Questions* for BlueJ
- Are there any initialisation files, configuration or preferences and how are they used ?

BlueJ — Exercise

Key Questions (6a)

- Answer the *Key Questions* for BlueJ
- Are there any initialisation files, configuration or preferences and how are they used ?

  Tools > Preferences...

  BlueJ.defs

```
##    <USER_HOME>/.bluej/bluej.properties                    (Unix)
##    C:\Winnt\profiles\<USER_NAME>\Bluej\Bluej.properties   (WinNT)
##    C:\<JDK_HOME>\Bluej\Bluej.properties                   (Win9x)
```

- Notice SaaSHub: Is BlueJ down ?

BlueJ — Exercise

Key Questions (7)

- Answer the *Key Questions* for BlueJ
- How do you import and export data from the package ?

BlueJ — Exercise

Key Questions (7a)

- Answer the *Key Questions* for BlueJ
- How do you import and export data from the package ?
- **Export**
- Using code outside BlueJ
- **Import**
- Using code developed in another editor or IDE

BlueJ — Exercise

Key Questions (8)

- Answer the *Key Questions* for BlueJ
- *When all else fails*, how can you obtain advice ?

BlueJ — Exercise

Key Questions (8a)

- Answer the *Key Questions* for BlueJ
- *When all else fails*, how can you obtain advice ?

  M250 Forums

  BlueJ Web site

  StackOverflow: Questions tagged [bluej]

Writing Programs & Thinking

The Steps

1. Invent a *name* for the program (or function)
2. What is the *type* of the function ? What sort of *input* does it take and what sort of *output* does it produce ? In Python a type is implicit; in other languages such as Haskell a type signature can be explicit.
3. Invent *names* for the input(s) to the function (*formal parameters*) — this can involve thinking about possible *patterns* or *data structures*
4. What restrictions are there on the input — state the preconditions.
5. What must be true of the output — state the postconditions.
6. *Think* of the definition of the function body.

Writing Programs & Thinking

The *Think* Step

- **How to Think**
  1. Think of an example or two — what should the program/function do ?
  2. Break the inputs into separate cases.
  3. Deal with simple cases.
  4. Think about the result — try your examples again.
- **Thinking Strategies**
  1. Don't think too much at one go — break the problem down. Top down design, step-wise refinement.
  2. What are the inputs — describe all the cases.
  3. Investigate choices. What data structures ? What algorithms ?
  4. Use common tools — bottom up synthesis.
  5. Spot common function application patterns — generalise & then specialise.
  6. Look for good *glue* — to combine functions together.

What Next ?

Programming, Debugging, Psychology

Although programming techniques have improved immensely since the early days, the process of finding and correcting errors in programming — known graphically if inelegantly as *debugging* — still remains a most difficult, confused and unsatisfactory operation. The chief impact of this state of affairs is psychological. Although we are happy to pay lip-service to the adage that to err is human, most of us like to make a small private reservation about our own performance on special occasions when we really try. It is somewhat deflating to be shown publicly and incontrovertibly by a machine that even when we do try, we in fact make just as many mistakes as other people. If your pride cannot recover from this blow, you will never make a programmer.

Christopher Strachey, Scientific American 1966 vol 215 (3) September pp112-124

What Next ?

To err is human ?

- To err is human, to really foul things up requires a computer.
- Attributed to Paul R. Ehrlich in 101 Great Programming Quotes
- Attributed to Bill Vaughn in Quote Investigator
- Derived from Alexander Pope (1711, An Essay on Criticism)
- *To Err is Humane; to Forgive, Divine*
- This also contains

  A little learning is a dangerous thing;
  Drink deep, or taste not the Pierian Spring
- In programming, this means you have to *read the fabulous manual* (RTFM)

What Next ?

Chps 1–4, TMA01

- Chps 1–3, Data types and expressions; Class definitions
- Tutorial 10:00 Sunday 9 November 2025 online
- Chps 4–5, Iteration, collections; Functional Java (optional)
- Tutorial 10:00 Sunday 16 November 2025 online
- TMA01 Thursday 11 December 2025

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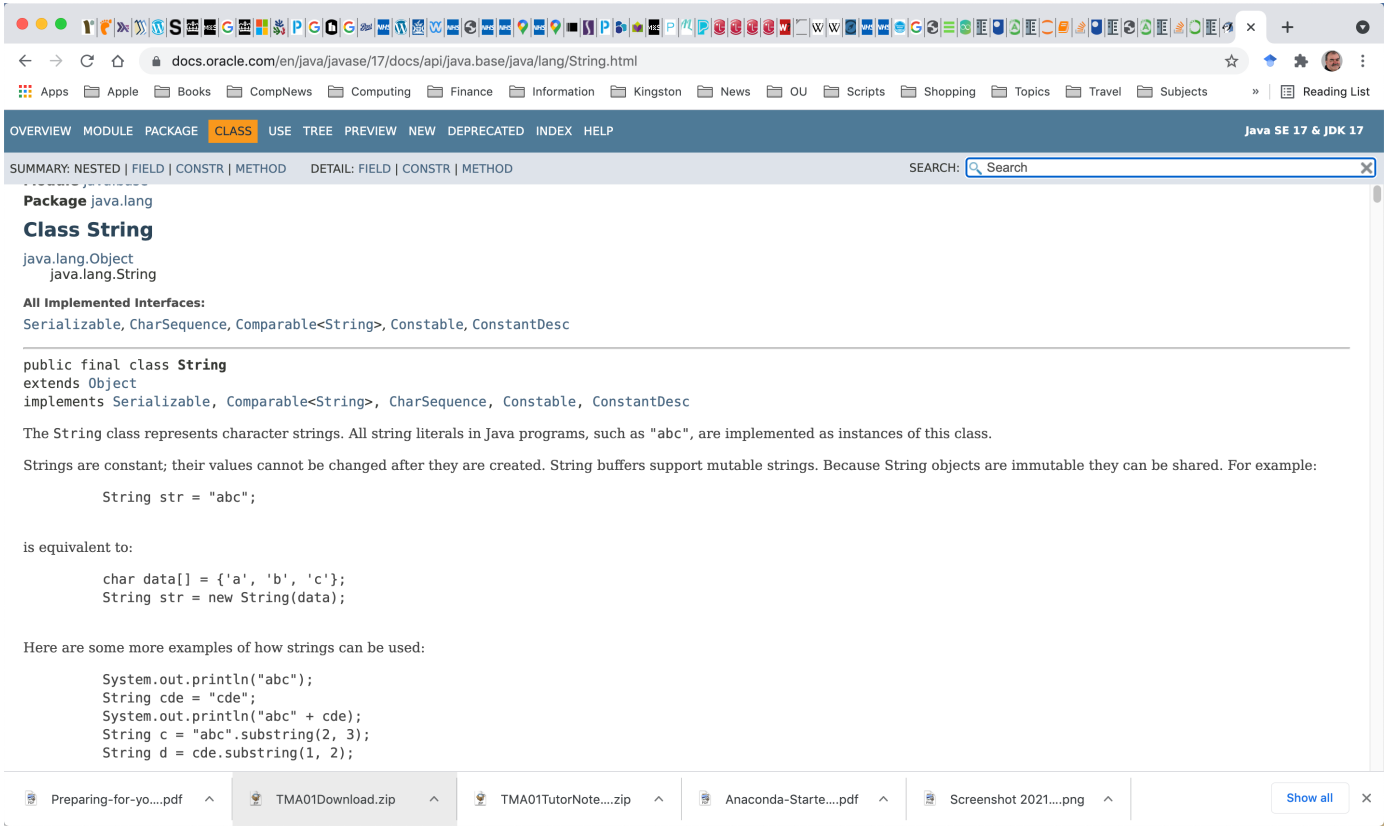
Web Links

- Java Documentation — BlueJ has JDK 7 embedded, JDK 13 is current (2019)
- JDK 13 Documentation
- Java Platform API Specification
- Java Language Specification
- JDK Documentation › API Documentation › java.base
  - java.lang — fundamental classes for the Java programming language
  - java.util — Collections framework

Java

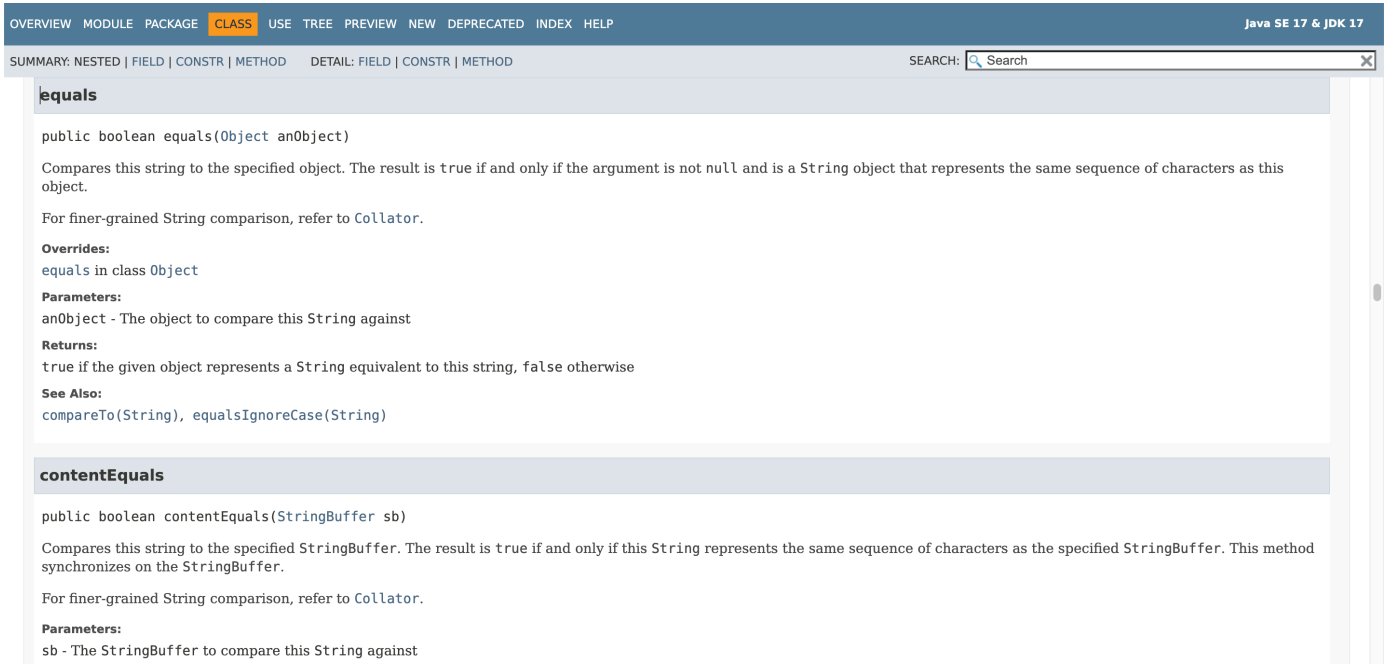
API Documentation (1)



- `Strings` are *immutable* objects
- See java.lang.StringBuilder for *mutable* strings
- In a *functional programming approach* everything is immutable — it makes life simpler (but at a cost)

Java

API Documentation (2)



OVERVIEW MODULE PACKAGE CLASS USE TREE PREVIEW NEW DEPRECATED INDEX HELP Java SE 17 & JDK 17

SUMMARY: NESTED | FIELD | CONSTR | METHOD DETAIL: FIELD | CONSTR | METHOD SEARCH: Search

equals

`public boolean equals(Object anObject)`

Compares this string to the specified object. The result is `true` if and only if the argument is not `null` and is a `String` object that represents the same sequence of characters as this object.

For finer-grained String comparison, refer to `Collator`.

Overrides:

`equals` in class `Object`

Parameters:

`anObject` - The object to compare this `String` against

Returns:

`true` if the given object represents a `String` equivalent to this string, `false` otherwise

See Also:

`compareTo(String)`, `equalsIgnoreCase(String)`

contentEquals

`public boolean contentEquals(StringBuffer sb)`

Compares this string to the specified `StringBuffer`. The result is `true` if and only if this `String` represents the same sequence of characters as the specified `StringBuffer`. This method synchronizes on the `StringBuffer`.

For finer-grained String comparison, refer to `Collator`.

Parameters:

`sb` - The `StringBuffer` to compare this `String` against

- Remember (==) tests for *identity* — what does this mean ?

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Books Phil Likes

- M250 is self contained — you do not need further books — but you might like to know about some:
- Sestoft (2016) *Java Precisely* — the best short reference
- Evans, Flanagan (2018) *Java in a Nutshell* — the best longer reference
- Barnes, Kölling (2016) *Objects First with Java* — the BlueJ book — see www.bluej.org for documentation and tutorial
- Bloch (2017) *Effective Java* — guide to best practice