Data Structures

00 – Introduction

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Outline

- Module Description
- Learning Objectives
- Structure
- Assessment

Module Description

- "This module will instruct the student in object oriented programming techniques. It will illustrate object oriented programming concepts and equip the student with the knowledge to use objects in programming with confidence."

Learning Objectives

- Identify the **core packages** in the Java API.
- Create **interfaces** in Java.
- Define and use **exception classes**
- Distinguish between one dimensional arrays and multi dimensional arrays.
- Describe the basic **file handling** technique used in the Java language.
- Create user objects and use them in conjunction with **Java's collection classes**.
- Be aware of the different **Searching and Sorting techniques** available for processing collection classes.

Structure

- Week 01 : Inheritance & Polymoriphsm (Recap)

- 02 – 03 : Custom Exception Handling
- 04 – 05 : File Input/Output in Java
- 06 – 08 : The Collections Framework
- 09 – 11 : The Collections Algorithms

- Week 12 : Project Demos

Assessment

- 100% Continuous Assessment
  - 1 Individual Assignment – Due week 6 (50%)
  - 1 Team Project – Due week 11/Demos Week 12 (20%)
  - 1 In Class Exam – Due week 11 (30%)
- Project Ideas **MUST** be unique **AND** all your own original work (mostly!)
  - 1st come 1st served approach to Project Titles
  - ***Note : Assignment CAN overlap with Project***

20% REDUCTION PER DAY FOR EVERY DAY LATE

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Resources

Moodle Page

Module Overview

- 100% Continuous Assessment
  - One individual project, one group project, and one in class assessment (provisionally).
  - Lab exercises (non-CA) will also be assigned to help prepare you for the project work.
- Shared module with IT.
  - We will share slides, CA, etc.
- Eclipse IDE will be used for this module.
  - Install a recent version of Eclipse.
  - We will use Eclipse for any in-class worked examples and case studies.

What are Data Structures?

- Data structures describe how data are organised in a computer.
- This organisation allows for the efficient processing (storage, retrieval, etc.) of the data in order to make it useful.
- Different types of data require different types of data structures for different types of applications.
  - "Horses for courses." No one data structure is always best or suitable.
  - The choice of data structures is one of the most fundamental decisions in an application's development.

Continued...

- Different data structures:
  - Have different space requirements for any given data.
  - Have different levels of algorithmic efficiency for given operations applied to the data (sorting, searching, retrieval, insertion, etc.).
- We always want to save (memory) space and/or (processing) time by choosing appropriate data structures.
  - Sometimes we have to trade space for time, and vice versa.

What is a "Structure"?

- A structure is something that, essentially, has an ostensible shape and form.
- We humans see and use structure everywhere!
  - Its how we make sense of the complexity and chaos in the world.
  - The structure we perceive helps us to organise things in order to process them.
    - What this processing involves depends on the nature of the structure and its actual use or application.
      - Examples: adding, removing, inserting, reading/observing, aggregating, searching, etc.

What Do You See?

- Consider the following photographs / images.
- Can you see any structures or patterns?
  - Name the structures and any components / concepts you see.
  - The key point is that structures emerge that explain, describe and simplify the situation.

Continued…

Q. How would we?

- Add (or Insert)
- Remove
- Search
- Aggregate (e.g. Count)
- Organise further?

Continued…

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- Remove
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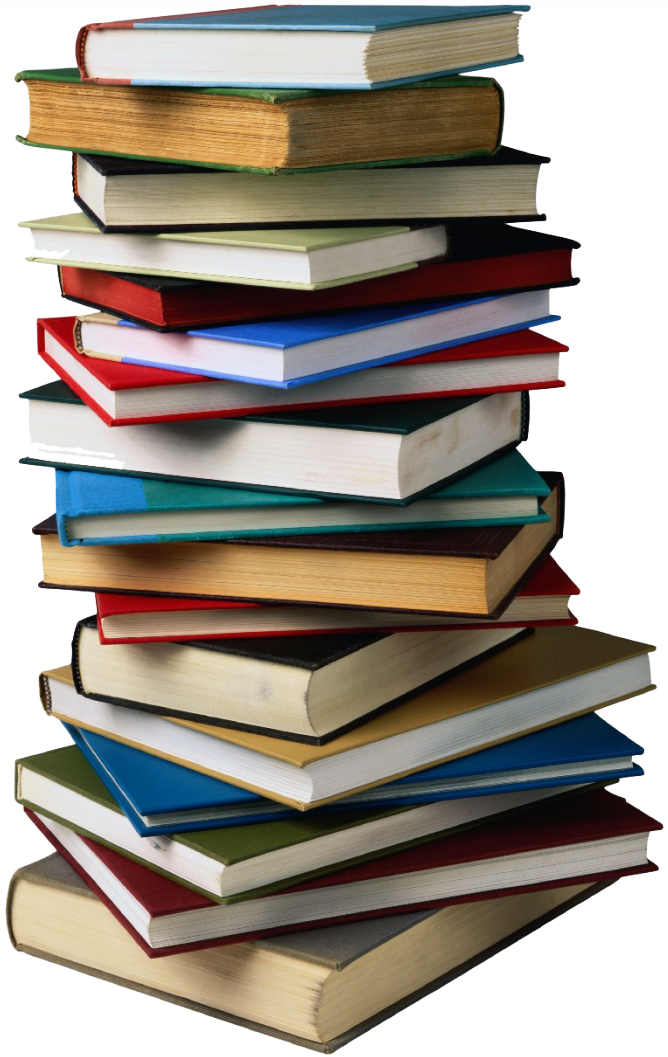
Continued…



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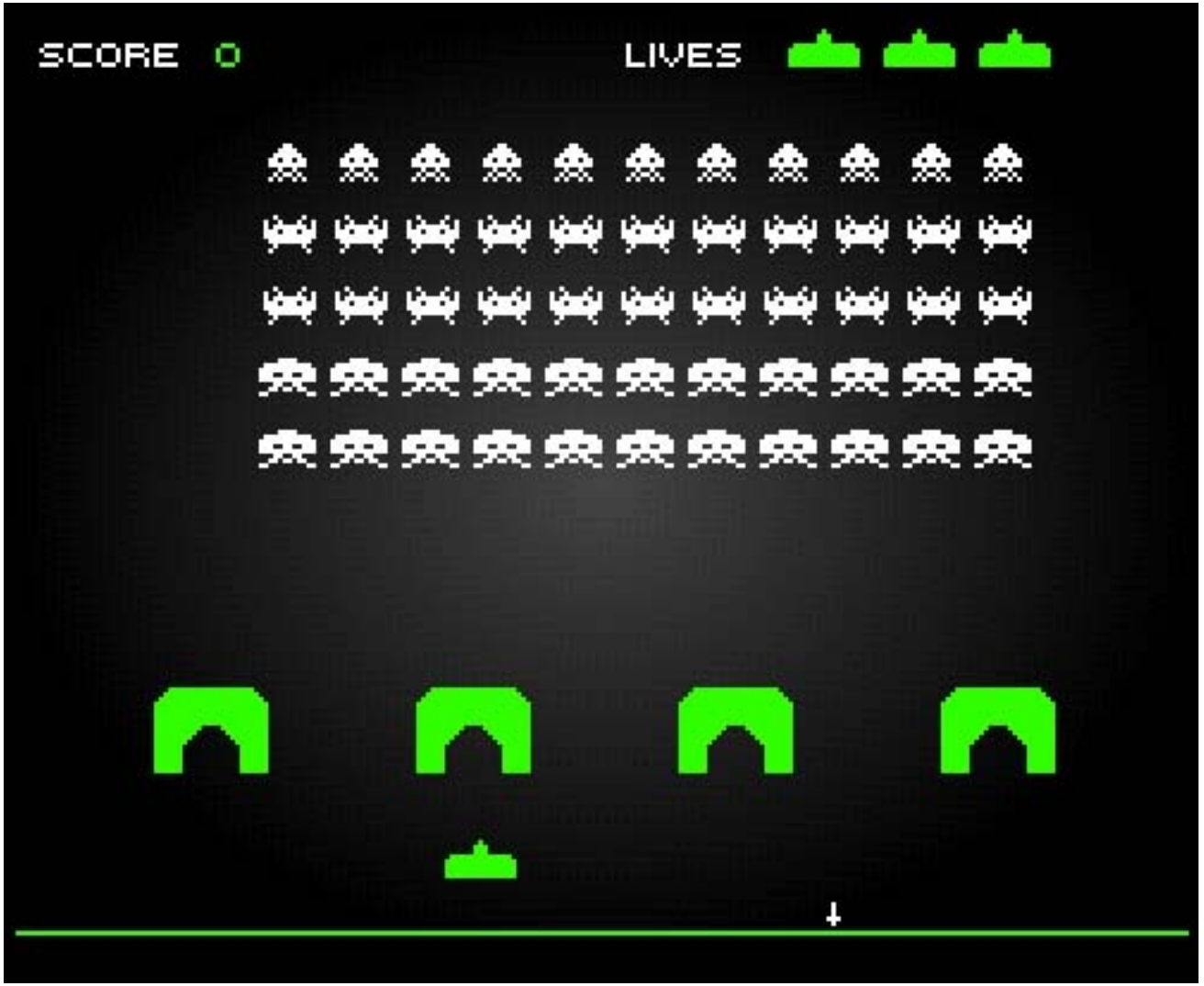
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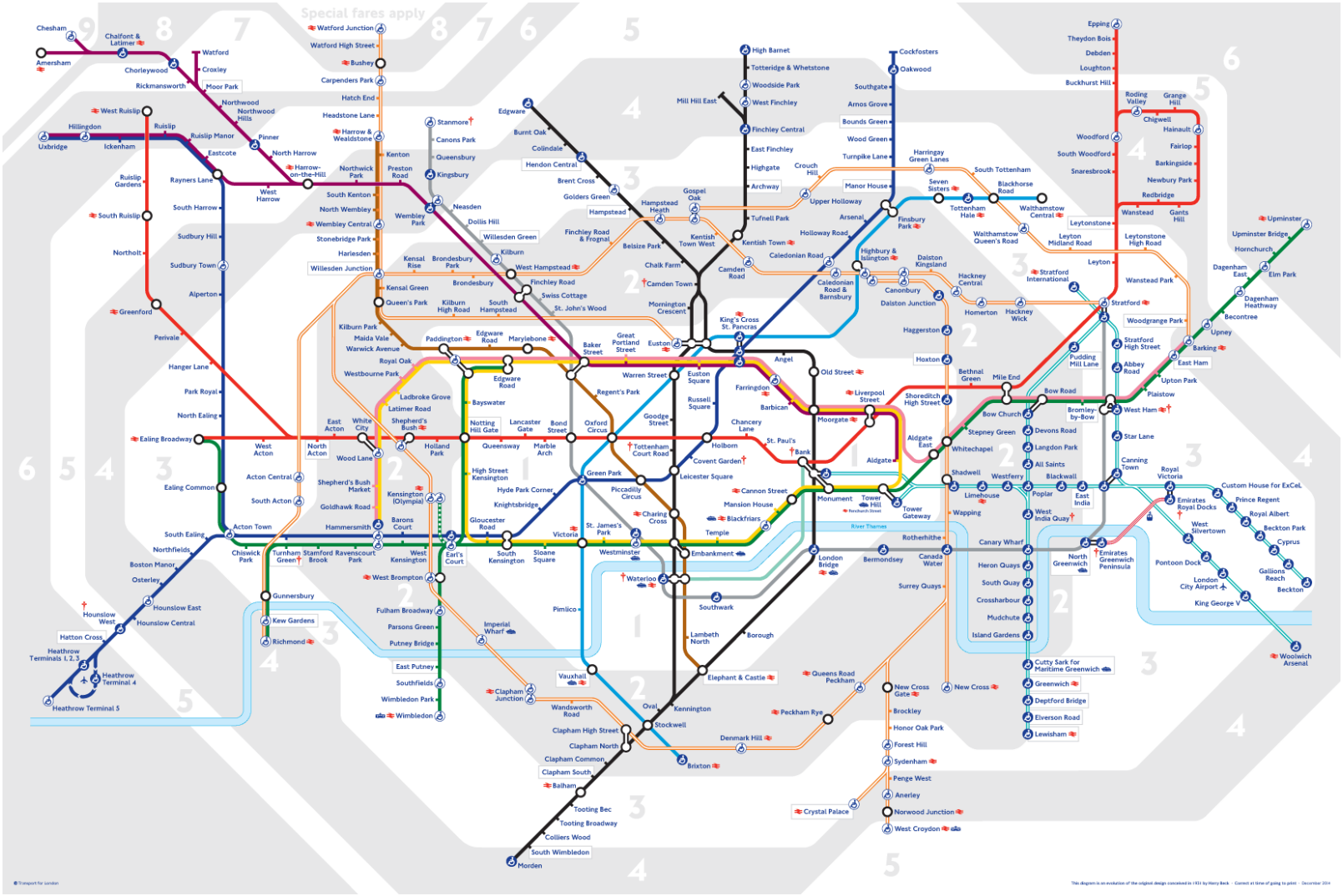
Special fares apply
Chesham
Amersham
Chalfont & Latimer
Chorleywood
Rickmansworth
Watford
Croxley
Moor Park
Northwood
Northwood Hills
West Ruislip
Ruislip
Ruislip Manor
Eastcote
Pinner
North Harrow
Hillingdon
Uxbridge
Ickenham
Ruislip Gardens
Rayners Lane
South Ruislip
South Harrow
Sudbury Hill
Sudbury Town
Northolt
Alperton
Greenford
Perivale
Hanger Lane
Park Royal
North Ealing
Ealing Broadway
West Acton
North Acton
East Acton
White City
Shepherd's Bush
Wood Lane
Holland Park
Acton Central
Shepherd's Bush Market
South Acton
Goldhawk Road
Ealing Common
Kensington (Olympia)
Hammersmith
Barons Court
Acton Town
South Ealing
Northfields
Boston Manor
Osterley
Hounslow West
Hounslow East
Hounslow Central
Hatton Cross
Heathrow Terminals 1, 2, 3
Heathrow Terminal 4
Heathrow Terminal 5
Chiswick Park
Turnham Green
Stamford Brook
Ravenscourt Park
West Kensington
Earl's Court
Gunnersbury
Kew Gardens
Richmond
West Brompton
Fulham Broadway
Parsons Green
Putney Bridge
East Putney
Southfields
Wimbledon Park
Wimbledon
Watford Junction
Watford High Street
Bushey
Carpenders Park
Hatch End
Headstone Lane
Harrow & Wealdstone
Harrow-on-the-Hill
Northwick Park
Kenton
Preston Road
South Kenton
North Wembley
Wembley Central
Stonebridge Park
Harlesden
Willesden Junction
Wembley Park
Stanmore
Canons Park
Queensbury
Kingsbury
Neasden
Dollis Hill
Willesden Green
Kilburn
West Hampstead
Kensal Green
Kensal Rise
Brondesbury Park
Brondesbury
Queen's Park
Kilburn High Road
South Hampstead
Finchley Road
Finchley Road & Frognal
Swiss Cottage
St. John's Wood
Kilburn Park
Maida Vale
Warwick Avenue
Royal Oak
Westbourne Park
Paddington
Edgware Road
Marylebone
Ladbroke Grove
Latimer Road
Bayswater
Notting Hill Gate
Lancaster Gate
Queensway
Bond Street
Marble Arch
Oxford Circus
Baker Street
Great Portland Street
Euston
Regent's Park
Warren Street
Euston Square
Russell Square
Goodge Street
Tottenham Court Road
Holborn
Covent Garden
Leicester Square
Piccadilly Circus
Green Park
Hyde Park Corner
Knightsbridge
High Street Kensington
Gloucester Road
South Kensington
Sloane Square
Victoria
St. James's Park
Westminster
Charing Cross
Embankment
Waterloo
Pimlico
Vauxhall
Clapham Junction
Wandsworth Road
Imperial Wharf
Edgware
Burnt Oak
Colindale
Hendon Central
Brent Cross
Golders Green
Hampstead
Hampstead Heath
Belsize Park
Chalk Farm
Camden Town
Mornington Crescent
Kentish Town West
Gospel Oak
Kentish Town
Camden Road
Caledonian Road
Caledonian Road & Barnsbury
Holloway Road
Arsenal
Finsbury Park
Highbury & Islington
Canonbury
Dalston Junction
Dalston Kingsland
Mill Hill East
High Barnet
Totteridge & Whetstone
Woodside Park
West Finchley
Finchley Central
East Finchley
Highgate
Archway
Crouch Hill
Tufnell Park
Upper Holloway
Manor House
Turnpike Lane
Wood Green
Bounds Green
Arnos Grove
Southgate
Cockfosters
Oakwood
Harringay Green Lanes
Seven Sisters
South Tottenham
Tottenham Hale
Blackhorse Road
Walthamstow Central
Walthamstow Queen's Road
Leytonstone
Leyton Midland Road
Leytonstone High Road
Wanstead
Gants Hill
Redbridge
Newbury Park
Barkingside
Fairlop
Hainault
Chigwell
Roding Valley
Grange Hill
Woodford
South Woodford
Snaresbrook
Epping
Theydon Bois
Debden
Loughton
Buckhurst Hill
Leyton
Stratford International
Stratford
Stratford High Street
Abbey Road
Wanstead Park
Woodgrange Park
Upton Park
East Ham
Barking
Upney
Becontree
Dagenham Heathway
Dagenham East
Elm Park
Hornchurch
Upminster Bridge
Upminster
Hackney Central
Hackney Wick
Homerton
Haggerston
Hoxton
Old Street
Angel
King's Cross St. Pancras
Farringdon
Barbican
Moorgate
Liverpool Street
Shoreditch High Street
Bethnal Green
Mile End
Bow Road
Bromley-by-Bow
West Ham
Bow Church
Stepney Green
Whitechapel
Aldgate East
Aldgate
Tower Hill
Monument
Tower Gateway
Shadwell
Limehouse
Wapping
Westferry
Poplar
East India
Devons Road
Langdon Park
All Saints
Blackwall
Canning Town
Royal Victoria
Star Lane
Pudding Mill Lane
Custom House for ExCeL
Prince Regent
Royal Albert
Beckton Park
Cyprus
Gallions Reach
Beckton
West Silvertown
Pontoon Dock
London City Airport
King George V
Woolwich Arsenal
Emirates Royal Docks
Emirates Greenwich Peninsula
North Greenwich
Canary Wharf
Heron Quays
South Quay
Crossharbour
Mudchute
Island Gardens
Cutty Sark for Maritime Greenwich
Greenwich
Deptford Bridge
Elverson Road
Lewisham
Canada Water
Rotherhithe
Bermondsey
London Bridge
Borough
Southwark
Lambeth North
Elephant & Castle
Queens Road Peckham
Peckham Rye
New Cross Gate
New Cross
Brockley
Honor Oak Park
Forest Hill
Sydenham
Penge West
Anerley
Norwood Junction
West Croydon
Crystal Palace
Oval
Kennington
Stockwell
Clapham High Street
Clapham North
Clapham Common
Clapham South
Balham
Tooting Bec
Tooting Broadway
Colliers Wood
South Wimbledon
Morden
Brixton
Denmark Hill
Wapping
River Thames

Continued…

- For data structures the same principle applies: identify a structure/form/shape that logically organises a "bunch of data" in a useful and efficient way.
  - So it is easy to read, delete, add to, search, etc. the data as appropriate.
- Data structures include: lists, queues, stacks, rings, sets, bags, maps, trees, graphs, etc.
- Abstract data types (ADTs) can also be used to describe basically anything!
  - Examples: Skydiver, Person, Box, Book, Tin, Flock, FlockFormation, Drawer, EatingUtensil, Basket, ClothingItem, Wardrobe, WardrobeRail, Family, Alien, Spaceship, Engine, City, Building, TubeStation, etc. etc.

Who Knew I Knew?

- You have already been using some data structures, and related concepts, in your Year 1 programming modules, including:
  - Arrays
  - Classes / ADTs
- Although you will have only seen these in pretty rudimentary form, they are widely used to form the basis of more complex data structures too.
- It is therefore important to reconsider these concepts from a data structures perspective to understand their relevant characteristics, and also their strengths and weaknesses in this regard. *We will start here!*

End of Notes

Questions?