Concepts in Programming Languages: Exercise Sheet and Revision Guide

§ Topic I. Introduction and motivation

Keywords:
- Programming-language concepts, design, methods, paradigms, influences; Application domains; Execution models; Foundations; Standardisation.

Tripos question:
- 2006 Paper 6 Question 7 (a)

§ Topic II. FORTRAN: A simple procedural language

Keywords:
- FORTRAN 77; Execution model; Compilation; Data types; Control structures; Syntax; Types; Storage; Aliasing; Parameters.

Tripos questions:
- 2006 Paper 6 Question 7 (b)
- 2007 Paper 5 Question 7 (a)
- 2009 Paper 3 Question 2 (a)
- 2010 Paper 3 Question 5 (a)
- 2007 Paper 6 Question 7 (c)

§ Topic III. LISP: Functions, recursion, and lists

Keywords:
- LISP; Programming-Language phrases; S-expressions; quote; Static and Dynamic scope; Abstract machine; Recursion; Garbage collection; Programs as data; Reflection; Parameter passing.

Tripos questions:
- 2006 Paper 6 Question 7 (c)
- 2007 Paper 5 Question 7 (b)
- 2007 Paper 6 Question 7 (a)
- 2008 Paper 6 Question 7 (a)
- 2009 Paper 3 Question 2 (a)
- 2011 Paper 3 Question 6 (a (ii))

§ Topic IV. Block-structured procedural languages — Algol and Pascal

Keywords:
- Parameters; Parameter-passing; Block structure; Algol 60; Recursion; Stack; Type system; Algol 68; BNF syntax; Heap; Garbage collection; Pascal; Quasi-strong typing; Variant records.

Tripos questions:
- 2006 Paper 6 Question 7 (b)
- 2007 Paper 5 Question 7 (c)
- 2007 Paper 6 Question 7 (b)
- 2008 Paper 5 Question 7 (a)
- 2008 Paper 6 Question 7 (b)
- 2009 Paper 3 Question 2 (c)
- 2010 Paper 3 Question 5 (a)
- 2011 Paper 3 Question 6 (a (i))
§ Topic V. Object-oriented languages — SIMULA and Smalltalk

Keywords:
- Objects in SML; Dynamic lookup; Abstraction; Subtyping; Inheritance;
  Subtyping vs. inheritance; SIMULA; Classes, objects and activation records;
  Subclasses and inheritance; Type checking and subtyping; Smalltalk; Dynabook;
  Syntax; Abstraction; Messages; Methods; Instance variables; Interfaces as types;
  Subtyping.

Tripos questions:
- 2006 Paper 6 Question 7 (d)
- 2007 Paper 6 Question 7 (d)
- 2008 Paper 5 Question 7 (c)
- 2007 Paper 6 Question 7 (d)
- 2011 Paper 3 Question 6 (a)

§ Topic VI. Types in programming languages

Keywords:
- Types; Type systems; Type safety; Type checking; Static vs. dynamic type
  checking; Type checking in SML; Type equality; Type declarations; Type
  inference; Type inference in SML; Polymorphism; let-polymorphism;
  Polymorphic exceptions.

Tripos questions:
- 2008 Paper 5 Question 7 (b)
- 2009 Paper 3 Question 2 (b)
- 2010 Paper 3 Question 5 (b)
- 2010 Paper 3 Question 5 (c)
- 2011 Paper 3 Question 6 (b)

§ Topic VII. Data abstraction and modularity — SML Modules

Keywords:
- Modules language; Signatures; Structures; Concrete and opaque signatures;
  Signature inclusion; Signature matching; Subtyping; Information hiding;
  Functors.

Tripos questions:
- 2007 Paper 5 Question 7 (d)
- 2009 Paper 3 Question 2 (d)
- 2010 Paper 3 Question 5 (d)
- 2011 Paper 3 Question 6 (c)

§ Topic VIII. The state of the art — Scala

Keywords:
- Scala; Procedural programming; Declarative programming; Mutable state; Blocks;
  Functions; Parameter passing; Classes and objects; abstract classes; traits; case
  classes; Pattern matching; Generic types and methods; Variance annotations;
  Functions as objects; Type parameter bounds; View bounds; Implicit parameters;
  Implicit conversions; Mixin-class composition.
Tripos questions:

- 2008 Paper 6 Question 7 (c)
- 2009 Paper 3 Question 2 (e)
- 2010 Paper 3 Question 5 (e)
- 2011 Paper 3 Question 6 (d)