**CS 4250 Programming Languages Fall 2018**

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**KEY TO HOMEWORK #1 [25 points].**

1. [4 points] Describe the connection between readability and overall simplicity of a programming language by giving at least two examples of potential problems.

*In particular, examples may be taken from pp. 7 – 9.*

1. [4 points] Identify common properties of the most recent versions of Ada and COBOL.

*Both are imperative languages and their latest versions have object-oriented features.*

1. [3 points] Identify operators in C that were modeled on similar operators in ALGOL 60.

*In particular, arithmetical operators (+, -, \*, / for both real and integer division), assignment operator, relational and logical operators.*

1. [6 points] Build a table identifying some major developments in major programming languages: (a) the concept of a block structure; (b) the first high-level language construct for macros; (c) timesharing; (d) concurrently executed subprograms; (e) user-defined data types; (f) dynamic typing. Include the time when they first occurred and in what language they appeared.

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| Feature | Language and year of the first release |
| the concept of a block structure | ALGOL60 (1960) |
| the first high-level language construct for macros | COBOL (1960) |
| timesharing | Basic (1964) |
| concurrently executed subprograms | ALGOL68 (1969): simple concurrency with semaphores for synchronization; Ada (1983): sharing data among concurrent processes |
| user-defined data types | Record in COBOL (1960); classes and objects in SIMULA67 (1967) |
| dynamic typing | APL (1960), Snobol (1962) |

1. [8 points] In recent years data structures have evolved within scripting languages to replace traditional arrays. Based on Chapter 2, explain the chronological sequence of these developments.

*Note that information in the table below is taken only from a textbook.*

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| Language | First appeared |  |
| Perl | 1987 | Dynamic length, sparse arrays, associative arrays |
| Python | 1990 | Instead of arrays, Python has 3 types of data structures: lists, immutable lists (tuples) and hashes (dictionaries). |
| Lua | 1993 | Table that extend PHP’s associative array is a single data structure in Lua. References to table elements can take the form of references to traditional arrays, associative arrays or records. |