Chapter 5 Homework
CSCI-400 Spring 2013

Exercise #1

1. [2] What is the difference between a "keyword" and a "reserved word"?

   (p206) A keyword is a special word whose use is only restricted in certain contexts, while a reserved word is a word that can never be used as a name.

2. [2] What is the difference between an "lvalue" and an "rvalue"?

   (pp208-9) An rvalue is an expression that determines the value that is to be written to storage and, hence, can appear on the right of an assignment operator. An lvalue is an expression that determines where in storage a value is to be written and, hence, can appear on the left of an assignment operator. A roughly equivalent distinction is that a variable's lvalue is the address of the memory allocated to that variable while the variable's rvalue is the value stored at that location.

3. [2] What are the four categories of storage bindings for scalar variables based upon lifetime?

   (p214) Static, stack-dynamic, explicit heap-dynamic, and implicit heap-dynamic.

4. [4] For each category in #3, give describe when and how the variable is bound to its storage?

   (p215) Static: Bound to storage before program execution begins.
   (p215) Stack-dynamic: Bound at runtime when the containing code is executed.
   (p216) Explicit heap-dynamic: Bound when memory is allocated via specific program instructions.
   (p218) Implicit heap-dynamic: Bound when a value is assigned to the variable.

5. [4] For each category in #3, give two advantages and two disadvantages.

   (p215) Static:
   Advantages: Fast access, no run-time overhead for allocation.
   Disadvantages: Reduced flexibility, memory cannot be used elsewhere.
   (p215) Stack-dynamic:
   Advantages: Automatically allocated/deallocated, permits recursion.
   Disadvantages: Overhead of allocation/deallocation, indirect access.
   (p216) Explicit heap-dynamic:
   Advantages: Very flexible, can be used to construct dynamic structures .
   Disadvantages: Easy to misuse pointers, indirect access, heap management.
   (p218) Implicit heap-dynamic:
   Advantages: Extremely flexible, allows for generic (type agnostic) code.
   Disadvantages: Run-time overhead, loss of some error-detection.

6. [4] For each category in #3, give an example of a variable in C that has that storage binding. If that type of binding is not supported in C, give an example of a language that does support it.

   (p215) Static: A global variable or a local variable that uses the static qualifier.
   (p215) Stack-dynamic: Non-static local variables (including function arguments).
   (p216) Explicit heap-dynamic: A variable created using malloc().
   (p218) Implicit heap-dynamic: Not supported. JavaScript and Python do.

7. [2] Static scoping is known by what other name?

   Lexical scoping

8. [4] What are some of the disadvantages of dynamic scoping? **(2pts each)**

   1) The referencing environment of a subprogram is dynamic and cannot be determined except at runtime, making it difficult to manage the visibility of variables.
   2) Variables at one level of the call stack are visible to all functions called from there, which may expose variables to being changed by functions that shouldn't do so.
   3) Non-local variables cannot be type checked because the declarations associated with them are not known until run time.
   4) Very inefficient access because the call stack must be searched.

9. [4] What does a "referencing environment" refer to?

   (p230) The collection of all variables that are visible in a statement.

10. [2] In C, what types of variables are implicitly initialized?

    Static variables (either global or local) are implicitly initialized to zero.

SUBMISSION

Submit your work as a pdf file named CS400_UserID_HW_xx.pdf to Blackboard.

GRADING RUBRIC – 40 pts

   10 - Good Faith effort.
   30 - As indicated by for each question.

   -10 - Improper submission.