CSE 461: Programming Languages Concepts
Homework 2: Due on **Feb 14th (Friday) at 6pm.**

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1. (4 points) In class, we discussed static local variables in C. Answer each question below; if necessary, find and consult a reference on the C language (cite your source in your answer).

Scope: Region of program where a variable is visible
Lifetime: Period of time when storage is allocated.

(a) For a non-static local variable in a C function, what is its scope and what is its lifetime?

Scope: Within function/block in which it is declared

Lifetime: Until end of function/block

(b) For a static local variable in a C function, what is its scope and what is its lifetime?

Scope: Within function/block in which it is declared

Lifetime: Until program stops running

(c) For a non-static global variable in C, what is its scope and what is its lifetime?

Scope: Visible throughout program after declaration,

Lifetime: Until program stops running

(d) For a static global variable in C, what is its scope and what is its lifetime?

Scope: Visible throughout program after declaration, only within file

Lifetime: Until program stops running

Source Cited: Chang, Richard. "Scope & Lifetime." Scope & Lifetime, UMBC, 2015, www.csee.umbc.edu/~chang/cs202.f15/Lectures/modules/m05-scope/slides.php

2. (3 points) Find some online material to learn PHP's namespace mechanism (cite your source). Explain briefly how it works and its benefits.

In PHP, namespaces are a way to encapsulate related items such as classes, interfaces, functions, and constants. They are most often used to create groupings to avoid conflicts in definition or implementation of those classes, interfaces, functions, and constants.

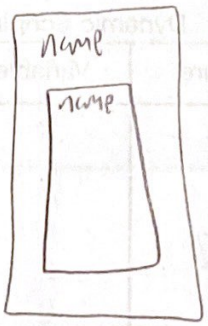
Benefits: Namespaces also allow for improved readability of code through aliasing, shortening long or unclear names.

Usage: Objects within namespaces can be referenced using '\' notation, eg. To access a class 'foo' in namespace 'fizzbuzz', In my function, I would reference 'fizzbuzz\foo'

Sources Cited: "Namespaces Overview – Manual." Php, www.php.net/manual/en/language.namespaces.rationale.php

3. (8 points) Consider the Ada program given below. You will be asked to determine which variables are visible in a number of different situations. In each case, identify each variable by its name and the line number of its declaration.

```
1.  procedure Main is
2.    A, B, C : Integer;
3.    procedure Sub1 is  <- start of declaration list
4.      D, E : Integer;
5.    begin -- of Sub1
6.    ...
7.    end; -- of Sub1
8.    procedure Sub2 is
9.      C, D : Integer;
10.     procedure Sub3 is
11.       B, D, F: Integer
12.     begin -- of Sub3
13.     ...
14.     end; -- of Sub3
15.     begin -- of Sub2
16.     ...
17.     end; -- of Sub2
18. begin -- of Main
19. ...
20. end; -- of Main
```



(a) Assuming that static scoping is used, say which variables are visible in the bodies of each of the procedures: Main, Sub1, Sub2 and Sub3.

Static Scoping Table

Procedure	Variable	Line #
Main	A	2
	A	2
Sub1	A	2
	B	2
	C	4
	D	4
	E	4
Sub2	A	9
	B	2
	C	9
	D	9
Sub3	A	9
	B	11
	C	9
	D	11
	F	11

(b) Assuming that dynamic scoping is used and the calling sequence is Main calls Sub1; Sub1 calls Sub2; Sub2 calls Sub3, say which variables are visible in Sub3.

Dynamic Scoping Table

Procedure	Variable	Line #
Main	A	2
	B	2
Sub1	A	2
	B	2
	C	4
	D	4
	E	4
Sub2	A	9
	B	2
	C	9
	D	9
	E	4
Sub3	A	9
	B	11
	C	9
	D	11
	E	4
	F	11

(c) Assuming that dynamic scoping is used and the calling sequence is Main calls Sub2; Sub2 calls Sub3; Sub3 calls Sub1, say which variables are visible in Sub1. Main→Sub2, Sub2→Sub3, Sub3→Sub1

Dynamic Scoping Table

Procedure	Variable	Line #
main	A B	2 2
Sub2	A B C D	9 2 9 9
Sub3	A B C D F	9 11 9 11 11
Sub1	A B C D E F	9 11 4 4 4 11

(d) Assuming that dynamic scoping is used and the calling sequence is Main calls Sub2; Sub2 calls Sub1, say which variables are visible in Sub1. NO Sub3

Dynamic Scoping Table

Procedure	Variable	Line #
main	A B	2 2
Sub2	A B C D	9 2 9 9
Sub1	A B C D E	9 2 4 4 4