CS3035 Programming Paradigms

Lab 02-1: Variable, Names, Bindings, and Scopes

Solution

Total Points: 20

Q1: [8 POINTS]

Consider the following C program:

```
void fun(void) {
  int a, b, c; /* definition 1 */
  . . .
  while (. . .) {
    int b, c, d; /*definition 2 */
    . . . <------------- 1
    while (. . .) {
    int c, d, e; /* definition 3 */
    . . . <-------------  2
    }
   . . . <--------------  3
   }
  . . . <----------------  4
}
```

For each of the four marked points in this function, list each visible variable, along with the number of the definition statement that defines it.

Answer:

Point 1:	a	1
	b	2
	c	2
	d	2
Point 2:	a	1
	b	2
	c	3
	d	3
	e	3

Point 3: same as Point 1

Point 4:	a	1
	b	1
	c	1

Q2: [6 POINTS]

Consider the following skeletal C program:

```
void fun1(void);  /* prototype */
void fun2(void);  /* prototype */
void fun3(void);  /* prototype */
void main() {
  int a, b, c;
  . . .
 }
void  fun1(void) {
  int  b, c, d;
  . . .
 }
void  fun2(void) {
  int  c, d, e;
  . . .
 }
void  fun3(void) {
  int  d, e, f;
  . . .
 }
```

Given the following calling sequences and assuming that dynamic scoping is used, what variables are visible during execution of the last function called? Include with each visible variable the name of the function in which it was defined.

a. `main` calls `fun1`; `fun1` calls `fun2`; `fun2` calls `fun3`.

b. `main` calls `fun1`; `fun1` calls `fun3`.

c. `main` calls `fun2`; `fun2` calls `fun3`; `fun3` calls `fun1`.

d. `main` calls `fun3`; `fun3` calls `fun1`.

e. `main` calls `fun1`; `fun1` calls `fun3`; `fun3` calls `fun2`.

f. `main` calls `fun3`; `fun3` calls `fun2`; `fun2` calls `fun1`.

Answer:

	Variable	Where Declared
(a)	d, e, f	fun3
	c	fun2
	b	fun1
	a	main
(b)	d, e, f	fun3
	b, c	fun1
	a	main
(c)	b, c, d	fun1
	e, f	fun3
	a	main
(d)	b, c, d	fun1
	e, f	fun3
	a	main
(e)	c, d, e	fun2
	f	fun3
	b	fun1
	a	main
(f)	b, c, d	fun1
	e	fun2
	f	fun3
	a	main

Q3: [6 POINTS]

Consider the following program, written in JavaScript-like syntax:

```
// main program
var x, y, z;

function sub1() {
var a, y, z;
. . .
}
function sub2() {
  var a, b, z;
  . . .
}
function sub3() {
  var a, x, w;
  . . .
}
```

Given the following calling sequences and assuming that dynamic scoping is used, what variables are visible during execution of the last subprogram activated? Include with each visible variable the name of the unit where it is declared.

a. `main` calls `sub1`; `sub1` calls `sub2`; `sub2` calls `sub3`.

b. `main` calls `sub1`; `sub1` calls `sub3`.

c. `main` calls `sub2`; `sub2` calls `sub3`; `sub3` calls `sub1`.

d. `main` calls `sub3`; `sub3` calls `sub1`.

e. `main` calls `sub1`; `sub1` calls `sub3`; `sub3` calls `sub2`.

f. `main` calls `sub3`; `sub3` calls `sub2`; `sub2` calls `sub1`.

Answer:

	Variable	Where Declared
(a)	a, x, w	sub3
	b, z	sub2
	y	sub1
(b)	a, x, w	sub3
	y, z	sub1
(c)	a, y, z	sub1
	x, w	sub3
	b	sub2
(d)	a, y, z	sub1
	x, w	sub3
(e)	a, b, z	sub2
	x, w	sub3
	y	sub1
(f)	a, y, z	sub1
	b	sub2
	x, w	sub3