COMS W4115 Programming Languages and Translators
Homework Assignment 3

Prof. Ronghui Gu Due Monday, April 22nd, 2019 at 11:59 PM

Submit this assignment online via Courseworks as a PDF file. Fill in or annotate this PDF or print it out, write on it, and scan it. Please keep your answers in the boxes.

Do this assignment alone. You may consult the instructor and the TAs, but not other students.

Name: | Uni:

1. (40 pts.) For the following C code,

```
if (a > b) { a = a - b; } else { b = a - (c * d); }
```

   (a) Construct its abstract syntax tree.

   (b) Translate it in to Three-Address Code representation.

(c) Partition the above Three-Address Code into basic blocks. Draw lines directly in the above box.

(d) Draw the control flow graph of the above Three-Address Code.

2. (20 pts.) For the following C code,

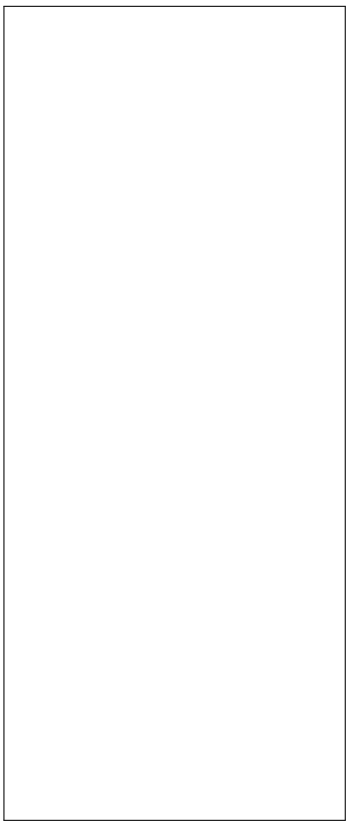
```
[1] int x;
[2] int main () {
[3]   int a = 10;
[4]   int b = 0; {
[5]     int b = 20;
[6]     while (a < b) {
[7]       int x;
[8]       x = a + 1;
[9]       b = x;
          ...
```

Draw the symbol table at line 9.

3. (20 pts.) Draw the layout of the stack just before *bar* is called in *foo*. Indicate storage for function arguments, local variables, return addresses, and stored frame pointers. Indicate where the stack and frame pointers point.

```
void bar(int x, int y, int z);

void foo(int a, int b) {
  int d, e;
  bar(2, 5, 7);
}
```



4. (20 pts.) For the program below written in a C-like language with nested function definitions,

```
void main() {
  int x = 5;

  void bar() {
    x = x + 2;
  }

  void foo() {
    int x = 8;
    bar();
    printf("%d\n", x);
  }

  foo(); /* Body of main() */
}
```

What would it print if the language used **static scoping**?

What would it print if the language used **dynamic scoping**?