CS117 (Programming Languages) Fall 2019 Lab (15 pts) Due: Nov. 01 (F)

1. Consider the following C/C++ code for the interpreter for the simplified infix expression.
   //keyboard input, single-digit numbers, no space, operations (+, -, *, /, ( ))

```
int Exp(), Term(), Exp2(int), Term2(int), Fact(); //prototypes
string prog; int indexx=0;

int main()
{ cout<<">"; cin>>prog; cout<<"result=  "<<Exp()<<endl;}

int Exp()
{ return Exp2(Term()); }

int Term()
{ return Term2(Fact()); }

int Exp2(int inp)
{ int result = inp;
  if (indexx < prog.length())
  { char a = prog.at(indexx++);
    if (a == '+')
       result = Exp2(result + Term());
    else if (a == '-')
       result = Exp2(result - Term());
  }
  return result;
}

int Term2(int inp)
{ int result = inp;
  if (indexx < prog.length())
  { char a = prog.at(indexx++);
    if (a == '*')
       result = Term2(result * Fact());
    else if (a == '/')
       result = Term2(result / Fact());
    else if (a == '+' || a == '-' || a == ')' )
       indexx--;
  }
  return result;
}

int Fact()
{ if (indexx < prog.length())
  { char a = prog.at(indexx++);
    if (a == '(')
       return Exp();
    else
       return atoi(&a);
   }
}
```

Assume that the input to this program is: (3+7)/5

(a) Show the activation tree. Please ignore showing atoi().

(b) Show the run time stack (one snapshot) when the right-side parenthesis is processed. (3+7)/5
You don't have to show the details in each A.R. – show only A.R. names.

2. Consider the following C/C++ code for the binary search program.

```
int x[ ] = { 0, 2, 5, 9, 14, 20, 27, 35, 44, 54, 65, 77, 90 };
int binary_search (int low, int high, int key)
{ int k;
  if (low > high) //not found
     return 0;
  k = (low + high) / 2;
  if (key == x[k]) //found
     return 1;
  else if (key < x[k])
     return binary_search(low, k-1, key);
  else if (key > x[k])
     return binary_search (k+1, high, key);
}
int main( )
{ if (binary_search(2, 12, 25))
     cout<<"found";
  else
     cout<<"not_found";
  return 0;
}
```

Show the snapshots of the run time stack (step by step).
You should show the details of the most recently activated A.R. only in each snapshot, i.e., static_link, dynamic_link, parameter names/values, local variable names/values.

Lab-AR report (15 pts) **Name:**

Please write the answer of #1 on this page and the answer of #2 on the back side.