This quiz has 3 questions, for a total of 10 points.

1. **4 points** Draw the abstract syntax tree (AST) for the following Python program. The AST should have a circle for each node, labelled with the kind of node (the name of the Python class), and a line connecting each node to its children.

   ```
   print 2 + 1 % -3, 5
   print 1 - + - 2
   ```

   ![Diagram of the AST](image)

   **Solution:**

2. **2 points** What is the output of the above program?

   **Solution:**

   ```
   0 5
   3
   ```

3. **4 points** Fill in the Python code that produces the C code for a `Printnl` AST node of the $P_0$ language. Recall that an instance of `Printnl` has a `nodes` attribute that contains a list of AST nodes.

   ```python
def generate_c(n):
    if isinstance(n, Const):
        return '%d' % n.value
    elif isinstance(n, Add):
        return '(' + generate_c(n.left) + '+' + generate_c(n.right) + ')
    ...
    elif isinstance(n, Printnl):

        space = 'printf(" ");'
        newline = 'printf("\n");'
        nodes_in_c = ['printf("%d", %s);' % generate_c(x) for x in n.nodes]
        return space.join(nodes_in_c) + newline
```