This exam has 2 questions, for a total of 10 points.

1. **2 points** What is the output of the following Python program?

   ```python
x = 1
class C:
    x = 2
    def __init__(self, x):
        self.x = x
    def f(self):
        return x
o = C(3)
print x
print C.x
print C.f(o)
print o.x
print o.f()
```

**Solution:**

```plaintext
2
1
2
1
3
1
```
2. **8 points** Convert the following program in the $P_3$ subset of Python into an equivalent $P_2$ program. That is, demonstrate that you know how the declassification pass works.

```python
x = 1
class C:
    x = 2
def __init__(self, x):
    self.x = x
def f(self):
    return x
o = C(3)
print o.f()
```

You may use the following runtime functions.

- `big_pyobj* create_class(pyobj bases); /* bases should be a list of classes */`
- `big_pyobj* create_object(pyobj cl);`
- `big_pyobj* get_receiver(pyobj o); /* Get the receiver from inside a bound method */`
- `big_pyobj* get_function(pyobj o); /* Get the function from inside a method */`
- `pyobj get_attr(pyobj c, char* attr);`
- `pyobj set_attr(pyobj obj, char* attr, pyobj val);`

You may also use **let** expressions, which have the following syntax

```plaintext
expr ::= "let" identifier "=" expr "in" expr
```

The the translation for function calls, you may omit all of the if expressions based on your knowledge of the type of the value in the function position.

**Solution:**

```python
x = 1

C_0 = create_class([])
set_attr(C_0, 'x', 2)
def 1__init__(self, x):
    set_attr(self, 'x', x)
set_attr(C_0, '__init__', 1__init__)
def 2_f(self):
    return x
set_attr(C_0, 'f', 2_f)
C = C_0

o = create_object(C)
gattr(C, '__init__', 0, 3)
print let rator_9 = get_attr(o, 'f') in
    get_function(rator_9)(get_receiver(rator_9))
```