ECE326 – Fall 2019: Week 4 Exercise Questions

1. True or False **[1 mark each]**

Circle T is true, otherwise circle F for false.

1. With C3 Linearization, Python completely solves the diamond problem. **T** **F**

2. 0x8888FEDC is a 4-byte aligned address. **T** **F**

3. Suppose class A is inherited by class B, and C, monotonicity guarantees that A will behave the same for both B and C. **T** **F**

4. Adding a new pure virtual function to a base class with many existing derived classes is an example of a fragile base class problem. **T** **F**

5. The main difference between delegation and type embedding is that with type embedding, you can no longer reference the embedded member by name. **T** **F**

2. Multiple Answers **[2 marks each]**

Pick all answer(s) that are correct. You will lose 1 mark per wrong choice, down to 0 marks.

1. Which of the following are true about mixins?

   (a) It requires subclass to complete its implementation.
   (b) It can contain both member variables and functions.
   (c) It is used as a super type to the derived class.
   (d) Using it requires method forwarding.
   (e) The order in which mixins are composed may change behaviour of the subclass.

2. Java only supports single inheritance with runtime polymorphism. Which of the following is true?

   (a) Java does not support mixins.
   (b) Java does not need virtual tables.
   (c) Casting pointers (internally, Java does not expose pointers to programmers) in Java will never require point offsetting.
   (d) Java does not need to deal with inheritance-related ambiguity.
   (e) Java does not have method resolution order.

3. Virtual Base Class in C++ **[10 marks]**

Draw the data layout of class X (include padding assuming 8-byte alignment, and write down the size of each sub-structure) and all the virtual tables generated for class X and its ancestors.

```
struct B {
  int b1;
  int b2;
  virtual void foo() { cout << “A.foo”; }
  virtual ~A() {}
};

struct P : virtual public B {
  long p1;
  virtual void foo() override { cout << “P.foo”; }
};

struct Q : public P {
  int q1;
};

struct N : virtual public B {
  char n1[30];
};

struct X : public N, public Q {
  int x1;
  virtual void foo() override { cout << “X.foo”; }
};
```

4. Method Resolution Order **[10 marks]**

a. For the following inheritance hierarchy in Python, draw a diagram of the hierarchy. [2 marks]

```
class A: pass
class B: pass
class C: pass
class D: pass
class E: pass
class P(A, B, C): pass
class Q(D, B, E): pass
class R(D, A): pass
class X(P, R, Q): pass
```

b. What is the C3 Linearization of X? [8 marks]