Question # 1 [50 Points]

void A_ping() { printf( "A_ping\n" ); }
void B_ping() { printf( "B_ping\n" ); }
void B_pong() { printf( "B_pong\n" ); }
void C_ping() { printf( "C_ping\n" ); }
void C_pong() { printf( "C_pong\n" ); }
void C_wiff() { printf( "C_wiff\n" ); }

struct A{
    void (*ping)();
};

struct B{
    void (*ping)();
    void (*pong)();
};

struct C{
    void (*ping)();
    void (*pong)();
    void (*wiff)();
};

struct B* new_B() {
    struct B* b = (struct B*)malloc( sizeof(struct B) );
    struct A* a = (struct A*)b;
    a->ping = B_ping;
    b->pong = B_pong;
    return b;
}

struct C* new_C() {
    struct C* c = (struct C*)malloc( sizeof(struct C) );
    struct A* a = (struct A*)c;
    a->ping = A_ping;
    c->pong = C_pong;
    c->wiff = C_wiff;
    return c;
}

void foo( struct A* a ) {
    a->ping();
}

void main( void )
{
    foo( (struct A*)new_B() );
    foo( (struct A*)new_C() );
}

When main() executes, what would the program output be, and why?
Answer:
B_ping Is assigning first function ptr offset of B to B_ping then second to B_pong
C_wiff Is assigning first function ptr offset of C to A_ping then third to C_pong then overriding first function ptr offset of C to C_wiff
Question # 2 [50 Points]

class Polygon {
    float width;
    float height;

    public void setDimensions( float w, float h ) {
        width = w;
        height = h;
    }

    public float area() {
        return ( width * height );
    }
}

class Triangle extends Polygon {
    public float area() {
        return ( width * height /2 );
    }
}

class PolymorphismApp {

    public static void printArea( Polygon p ) {
        System.out.println( "Area is " + p.area() );
    }

    public static void main( String[] args ) {
        Polygon obj1 = new Triangle();
        Triangle obj2 = new Triangle();
        Polygon obj3 = new Polygon();

        obj1.setDimensions( 3, 4 );
        obj2.setDimensions( 5, 6 );
        obj3.setDimensions( 4, 3 );

        printArea( obj1 );
        printArea( obj2 );
        printArea( obj3 );
    }
}

What is the program output, and why?

Answer:
Area is 6.0
Area is 15.0
Area is 12.0

Program output because of polymorphic dispatch, the dynamic type of the object determines what method to call.