Game Engineering 2D
Midterm 1 problems
Fall 2010

1. Give the ouput of the following C# Program:

```csharp
struct s1
{
   int x;
   int y;
}
class C1
{
    s1 str;
}
struct S2
{
   s1 str1;
   c1 cls;
}

class Program
{

    void twiddle1(S2 str)
    {
       str.str1.x = 1;
       str.str1.y = 2;
       str.cls.str.x = 3;
       str.cls.str.y = 4;
    }

    void twiddle2(S2 var str)
    {
       str.str1.x = 5;
       str.str1.y = 6;
       str.cls.str.x = 7;
       str.cls.str.y = 8;
    }

    public static void main(string[] args)
    {
         S2 str = new S2();
```

```
                str.str1 = new S1();
                str.cls = new C1();
                str.cls.str = new S1();
                twiddle1(str);
                Console.Println(str.str1.x);
                Console.Println(str.str1.y);
                Console.Println(str.cls.str.x);
                Console.Println(str.cls.str.y);
                twiddle2(str);
                Console.Println(str.str1.x);
                Console.Println(str.str1.y);
                Console.Println(str.cls.str.x);
                Console.Println(str.cls.str.y);
        }
    }
```

2. The following function is supposed to insert an element into a sorted linked list. It is, however, buggy. Fix the errors.

```
class ListElem
{
    public int data;
    public ListElem next;
    public ListElem prev;
}

class List
{
  ListElem first;
  ListElem last;

  void Insert(int data)
  {
    ListElem e = new ListElem();
    if (first == null)
    {
       first = new ListElem();
       last = new ListElem();
       first.data = data;
    }
    ListElem tmp = first;
    while (tmp.data > elem)
    {
        tmp = tmp.next;
```

```
    }
    e.prev = tmp.prev;
    e.next = tmp;
    tmp.prev = e;
    tmp.prev.next = e;
  }
}
```
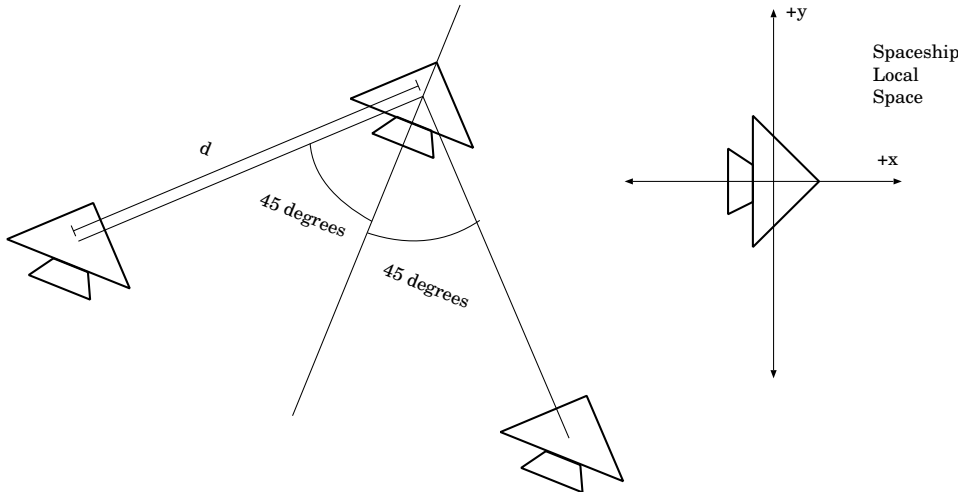
3. A robot has an orientation defined by the matrix M_r and position p_r, in global space. The robot's hand has an orientation and position defined by M_h and p_h *in the local space of the robot.* The robot is grasping a gun, which is at orientation and position M_g and p_g *in the local space of the hand of the robot.* Give the position and orientation of the gun in Global Space.

4. A spaceship s has an orientation defined by the following rotational matrix:

$$M = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

and position $p = [x, y]$.

The spaceship points down the x axis in its local space. The ship is flying in formation with two ships s_2 and s_3 that are at a distance d away, each at a 45 degree angle from the original ship:

Give the positions (as rotational matrices) and positions of s_2 and s_3, as a funciton of a, b, c, d, x, y.