

CMSC425: Spring 2019**Midterm 2
Worth: 100**

This exam is closed book and closed notes with the exception of one sheet of notes. Please turn in the notes with the exam. You may use any algorithms or results given in class or in the Mount lecture notes. We do not expect proofs, but do expect you to support answers when asked.

The boxes here are for Gradescope. Put your primary answer in each box. If you have supporting comments, scratch work, or other, put it on other blank sections and we will be able to see and take it into account. If a blank section is small it means the answer is short, but not the reverse.

Your Name

I pledge on my honor that I have not given or received any unauthorized assistance on this examination.

Your Signature

Problem	Topic	Worth
1	Short answer	/20
2	Navigation and obstacles	/15
3	L-System	/20
4	Flocking and crowd motion	/15
5	Winged edge mesh representation	/15
6	A*	/15

Problem 1. Short answer (20 pts, 3-4 each). Explanations are not needed, but may be given for partial credit, or to insure we understand your answer.

a) *Bump mapping*. Bump mapping is : (put your answer in the box).

a. Mapping street potholes

b. Mapping mountain ranges

c. Tweaking surface normals for texture

d. Making fractal mountains

b) *Perlin noise*. Why do values of persistence between 0 and 1 help smooth Perlin noise?

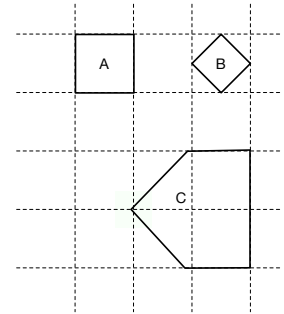
c) *Path quality*. Name two element other than distance might you use in weighing navigation path quality

d) *Configuration space*. How many degrees of freedom would the configuration space for tank that can move forward in any direction and has a turret that can rotate and lift the canon?

e) *Cubic curves*. If you have a cubic curve with the equation $p(t) = at^3 + bt^2 + ct + d$ and one point with position x_0 and tangent dx_0 , what constraints on parameters a, b, c and d do you have?

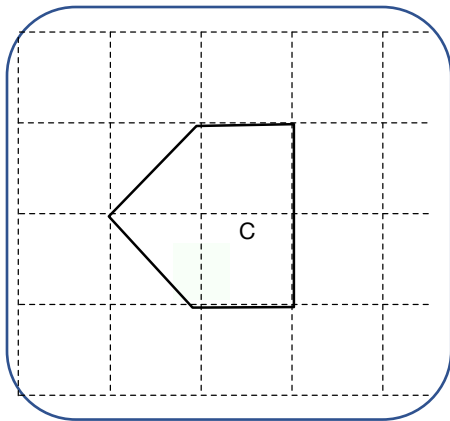
Problem 2. Navigation and obstacles (15 pts).

C-obstacles. Given the obstacle of the large diamond C in this diagram answer the following:

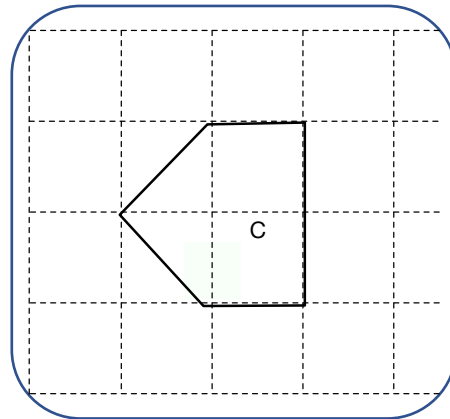


Sketch below the C-obstacles that result from the moving shapes A and B. Your sketches can be approximate. Use the centroid of each shape.

a) With A



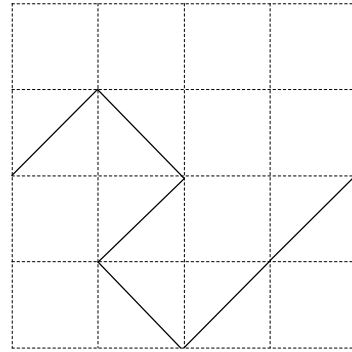
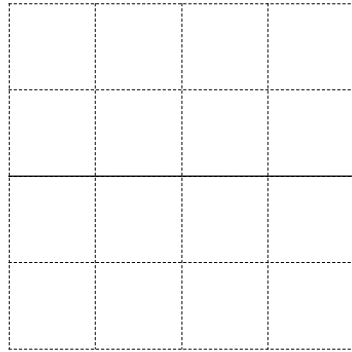
b) With B



c) What difference would it make to shape and position of the C-obstacle if you use the right corner point on the square A instead of the centroid?



Problem 3. L-System (20 points). Given this diagram of recursive step of a possible L-system curve, with the initiator on the left and the next step on the right, answer the questions below.



a) Give an L-system with grammar for drawing the shape defined by the curve?

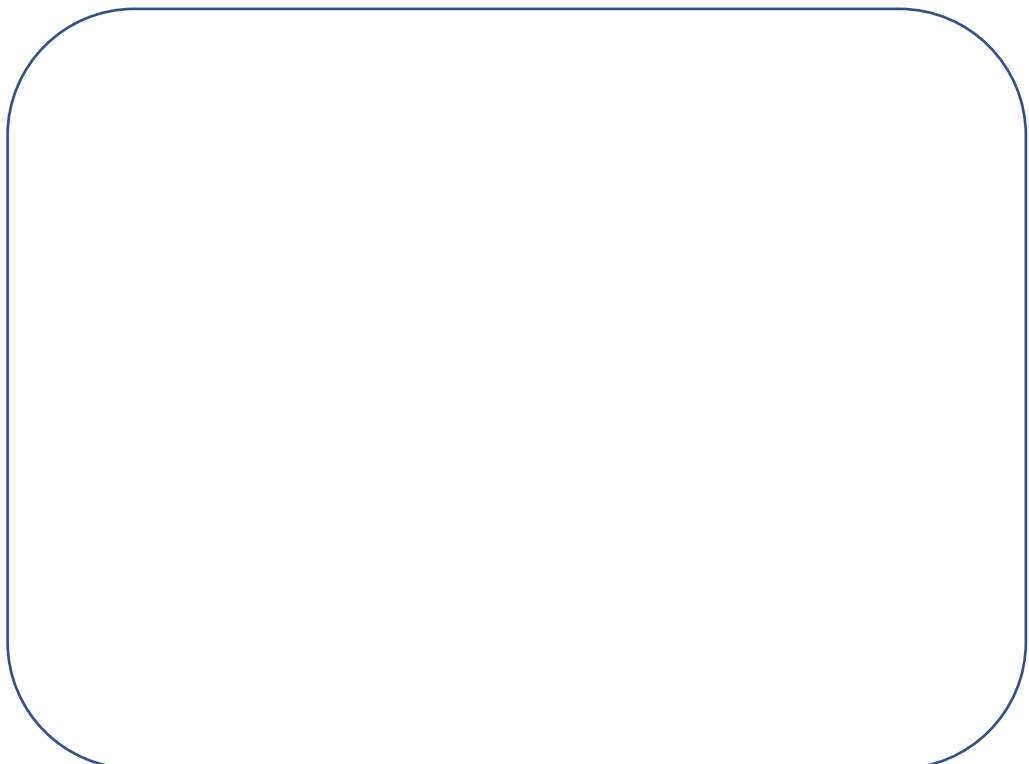
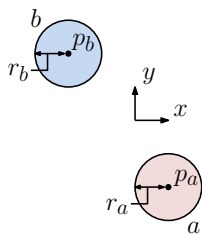
b) Give the fractal dimension of the curve.

Problem 4. Flocking and crowd motion (15 points). Let's assume you have game with a NPC wolf pack that chases the player, and the wolf pack exhibits flocking behavior. It stays together, but can separate to go around an obstacle.

a) Describe at least three forces you'd apply to each wolf.



b) One way to insure two wolves do not collide is to compute a forbidden region of velocities for each pair of wolves based on their current velocities. If you have two wolves a and b in 2d space like on the left, how do you compute a forbidden region of velocities for a if b is static?



Problem 5. Winged edge mesh representation (20 points).

The DECL representation is given on the right. Given this, answer the questions below.

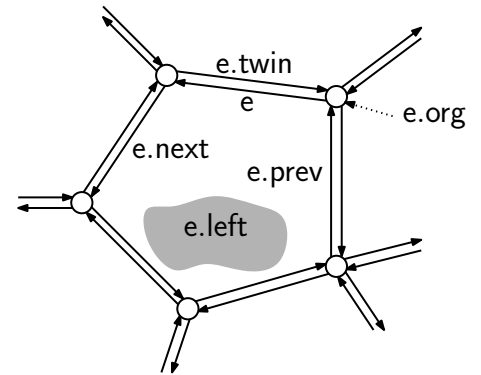
First: give short expressions to give:

a) e.right: the face on e's right side

b) e.onext: the next half-edge that shares e's origin that comes after e in ccw order

c) Give an algorithm to give the *right* face of e in ccw order.

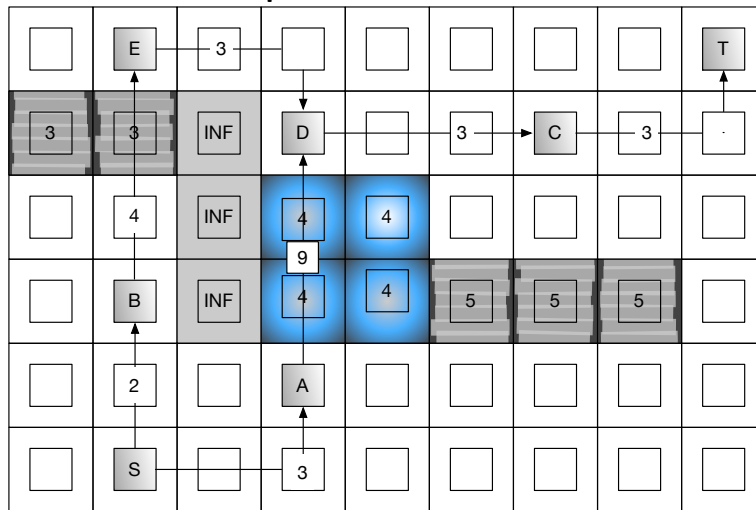
d) Give an algorithm to give all the vertices adjacent to e.org in any order.



Problem 6. continued

Given the data in the diagram above, show the result of A* from S to T using the Manhattan distance heuristic.



Problem 6: Table repeated**Scratch paper**

If you want us to check anything here please make a note at the original question.

Scratch paper

If you want us to check anything here please make a note at the original question.