

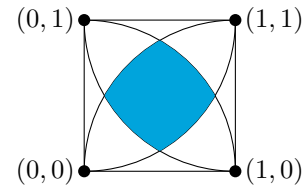
Cmpe 300: Homework 3 — Due: December 30th 17:00

The purpose of this homework is to familiarize you with algorithm analysis. Solve the following questions in \LaTeX or using a word processor. Submit your solutions to Moodle as a PDF. [Due date is strict](#). You do not have to print the questions. Your answers need not be on separate pages.

- This is an individual assignment, so work on your own.
- Please do not submit just an answer, and rather show all your reasoning.
- For any further questions, contact the assistant at utkan.gezer@boun.edu.tr.

1. **(50 pts)** Solve the following parts concerning the figure to the right.

Description of the figure The side length of the square is 1 unit. There are 4 quarter-circles at each corner. They each have a radius of 1 unit. The blue area is the intersection of those quarter-circles.



- (a) Write a numerical probabilistic algorithm approximating the blue area in the figure.

Hint Write an inequality for the circular areas centered at each corner. A point satisfying all of those inequalities is a point in the blue area, and vice versa.

- (b) Generate 10 random points within the square (x, y pairs between 0 and 1) using your favorite programming language or the [Random Decimal Fraction Generator of Random.org](#).

- (c) Mark the points that lie within the blue area, and give an approximation for the blue area.

Due: ~~Dec 28 10:00~~ Dec 30 17:00

2. **(50 pts)** Suppose that there are n -dimensional m lists, and that the first k of the lists are sorted in the ascending order. What is the smallest number of comparisons needed (i.e. the lower bound) in order to find the maximum element among the $m \cdot n$ elements, given the following conditions:

(a) $k = 0$

(b) $k = m$

(c) $0 < k < m$