

BBM 205 - Discrete Structures Midterm

Date: 19.11.2015, Time: 10:00 - 11:45

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Şube /Section:

Question	1	2	3	4	5	6	Total
Points	15	15	10	20	20	20	100
Grade							

1. (15 points) There are 13 squares of side 1 positioned inside a circle of radius 2. Prove that at least 2 of the squares have a common point. (Let $\pi = 3.14$. The area inside a circle with radius r is πr^2 .)

2. (15 points) Let $f(n) = n + 1$ and $g(n) = n^2$. Prove that $g(n) \neq O(f(n))$.
3. (10 points) Find the minimum number of ordered pairs of integers (a, b) that guarantees that there are two ordered pairs (a_1, b_1) and (a_2, b_2) such that $a_1 \equiv a_2 \pmod{5}$ and $b_1 \equiv b_2 \pmod{5}$. Explain your answer.

4. (20 points) Find the solution of the recurrence relation

$$a_n = 8a_{n-1} - 16a_{n-2}$$

with initial conditions $a_0 = 1$, $a_1 = 7$.

5. (20 points) Let x be any real number greater than -1 . Prove that

$$(1+x)^n \geq 1+nx$$

for every integer $n \geq 0$.

6. (20 points) A bagel shop (simit dükkanı) has onion (Soğanlı) bagels, poppy seed (Haşhaşlı) bagels, egg (Yumurtalı) bagels, salty (Tuzlu) bagels, pumpernickel (Çavdarlı) bagels, sesame seed (Susamlı) bagels, raisin (Üzümlü) bagels, and plain (Sade) bagels. How many ways are there to choose

(a) (4 points) six bagels?

(b) (4 points) a dozen bagels? (a dozen = 12)

(c) (4 points) two dozen bagels?

(d) (4 points) a dozen bagels with at least one of each kind?

(e) (4 points) a dozen bagels with at least three egg bagels and no more than two salty bagels?