

ANKARA UNIVERSITY
COMPUTER ENGINEERING
COM2067/COM267
FINAL 200 m.

You need to place your answers into a single pdf file and upload them. Make sure your answers are readable. Name your file as OgrenciNumarasi.pdf.

Read the questions carefully. Do not write code for the answers. Use the methods described in the lecture and mentioned in the slides for the solutions.



ANKARA ÜNİVERSİTESİ
MÜHENDİSLİK FAKÜLTESİ



SINAVLAR VE ÖDEVLER İÇİN ŞEREF SÖZÜ

Bir Ankara Üniversitesi öğrencisi olarak;

- -Bu ödevde/sınavda yardım almadığımı ya da hiç kimseye yardım etmediğimi,
- -Başkasına ait olan bir çalışmayı kendi çalışmam olarak sunmadığımı,
- -Sınav/ödev sorularının çözümü için hiç kimseden (öğrenci, öğretim üyesi ya da arkadaş) yardım istemediğimi,
- -Problemin çözümünü bulmak için interneti ya da çevrimiçi ya da basılı herhangi bir belgeyi kullanmadığımı beyan ederim.

Yukarıdaki ifadelere uymadığının tespit edilmesi durumunda sınavdan/ödevden sıfır alacağımı ve hakkımda **Ankara Üniversitesi Öğrenci Disiplin Yönetmeliği** çerçevesinde soruşturma açılacağını biliyorum.

HONOR CODE FOR EXAMS and ASSIGMENTS

As an Ankara University student, I agree that;

- I have neither given nor received unauthorized assistance on this exam or assignment.
- I have not represented the work of another as my work.
- I have not asked someone else (student, teacher, and friends) to help with this assignment or exam questions.
- I have not used the internet or any online or printed document to find problem solutions

I understand that failure to comply with the statements above will result in receiving a zero from this exam/assignment and being reported for academic dishonesty by the **disciplinary policies of Ankara University**.

1. (10 p) Using the two different methods below, insert the given values to the hash table that can contain at most 10 elements. For this question, simply fill in the table below.

(a) Linear Probing

Hash function: $h(k)=k \bmod 10$

(b) Quadratic Probing

Hash function:

$$h(k, i) = [h'(k) + c_1*i + c_2*i^2] \bmod 10 \quad (h' = k \bmod 10, c_1=3, c_2=1)$$

35, 46, 45, 50, 26, 12, 55, 17, 7

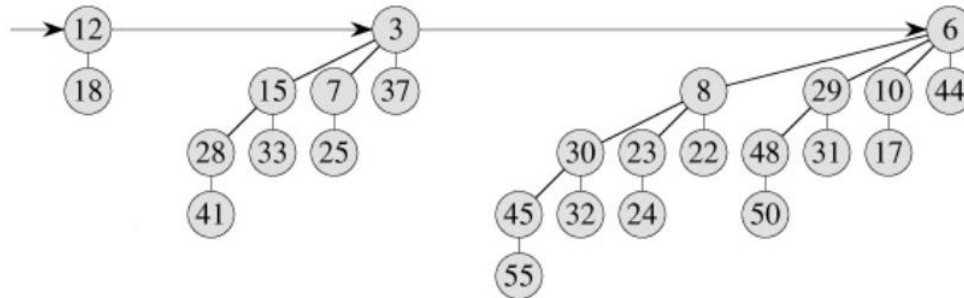
(a)	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

(b)	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

2. (15 p) Insert the following integer keys into a red-black tree. Show the red-black tree after each insertion that cause change in the tree.

24, 18, 43, 57, 90, 35, 60

3. (15 p) Extract the key with value 48 from the following binomial heap. Draw the produced binomial heap after this operation. Show all of the steps of producing this binomial heap.



4. (15 p) Create a Huffman tree using the following uppercase letters. Assume that only those letters are used in the text. Given values represent the estimated frequencies of each letter in a paragraph. Using the created Huffman tree, specify a binary coding for each letter.

P	S	M	Y	K	E	A
4	6	8	9	12	14	16

5. (10 p) Construct a binary tree from the following traversal results. Describe the steps.

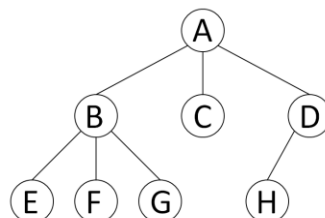
In-Order Traversal: 6 4 1 3 0 5 9 7 8 2

Pre-Order Traversal: 0 1 4 6 3 2 5 7 9 8

6. (15 p) Insert the following integer keys into an AVL tree. After each balancing (rotation) operation, write which rotation you have performed and show the AVL tree.

50, 40, 25, 10, 15, 5, 45, 35, 20, 30

7. (10 p) Convert the given general tree into a binary tree. Show each step.



8. (10 p) Apply the following insert and delete operations on 2-3 tree. Show 2-3 tree after each operation.

Insert 25, 15, 5, 30, 20, 35, 40

Delete 30