VIETNAM NATIONAL UNIVERSITY HO CHI MINH CITY
UNIVERSITY OF INFORMATION TECHNOLOGY
FACULTY OF COMPUTER SCIENCE

EXERCISE REPORT
GREEDY APPROACH

Lecturer: Son Nguyen Thanh McS

Class: CS112.N21.KHTN

Members: Hoang Ha Van - 21520033

Anh Vo Thi Phuong - 21522883

Date: 22/05/2023

Contents

1. Exercise 1

1.1. Problem:

Design and conduct an experiment to empirically compare the efficiencies of Prim's and Kruskal's algorithm on random graphs of different sizes and densities.

1.2. Solution:

We generated 2 tests:

- Dense connected graph: $|V| = 10000, |E| = 5000000$

- Sparse connected graph: $|V| = 500000, |E| = 2000000$

```
Dense connected graph: (n = 10000, m = 5000000)
Result (Kruskal) << 12163683971
Time: 321 ms
Result (Prim) << 12163683971
Time: 31 ms

Sparse connected graph: (n = 500000, m = 2000000)
Result (Kruskal) << 74718768204577
Time: 125 ms
Result (Prim) << 74718768204577
Time: 268 ms
```

The experiment showed that Kruskal's algorithm is better on sparse graph but Prim's algorithm is better on dense graph.

Implementation: Here

2. Exercise 2

2.1. Problem:
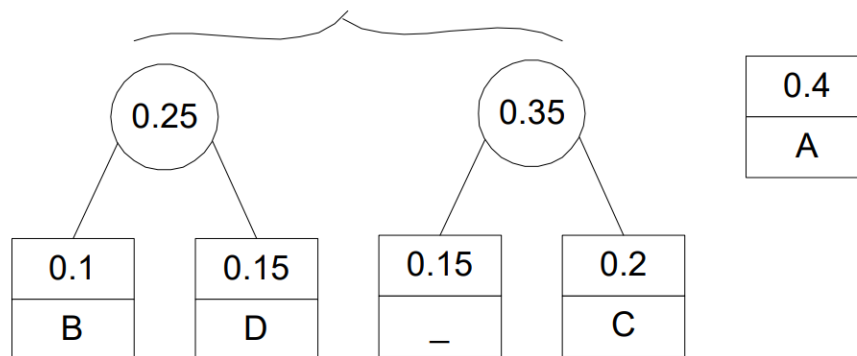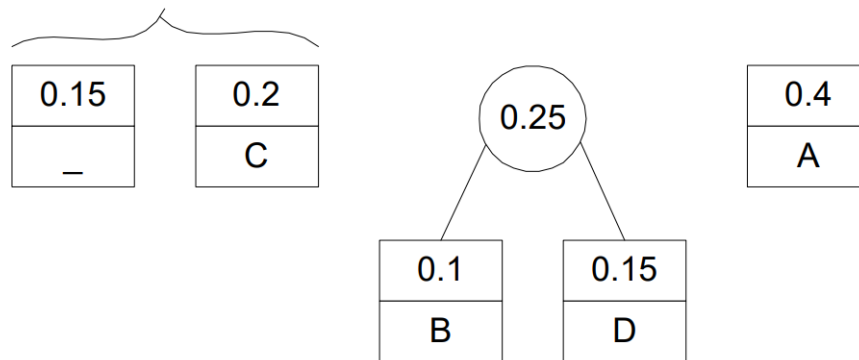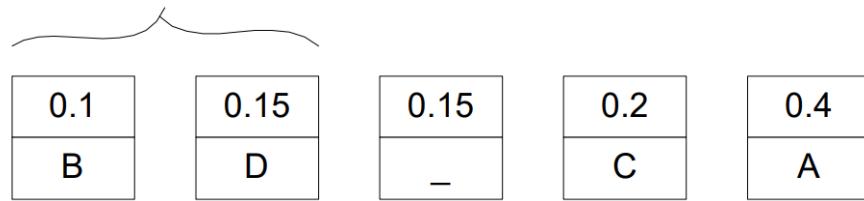
a. Construct a Huffman code for the following data:

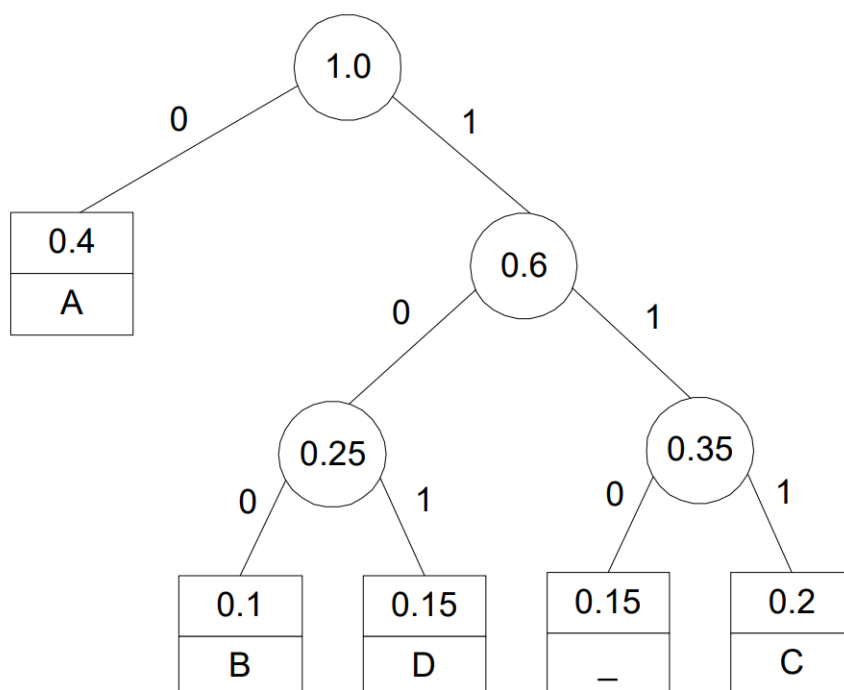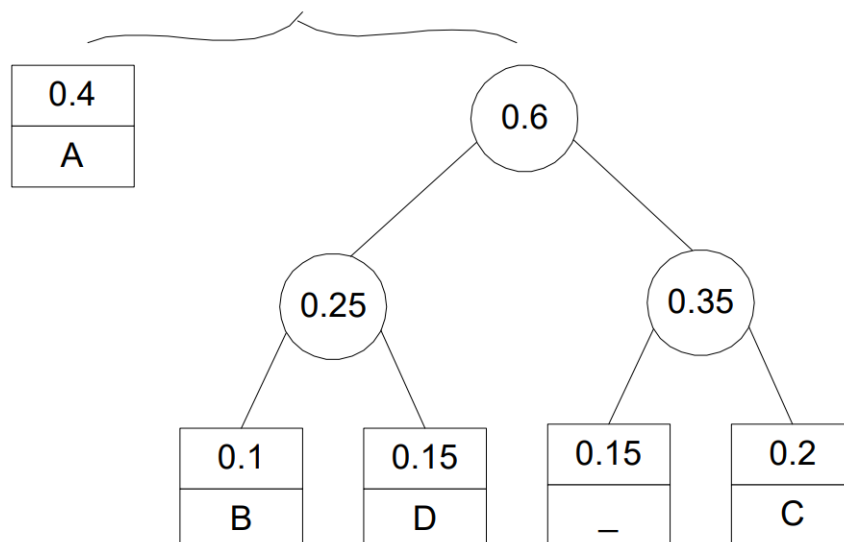| symbol	A	B	C	D	_
frequency	0.4	0.1	0.2	0.15	0.15

b. Encode ABACABAD using the code of question (a).

c. Decode 100010111001010 using the code of question (a).

2.2. Solution:

a. Construction steps:

0.1	0.15	0.15	0.2	0.4
B	D	_	C	A

0.15	0.2	0.25	0.4
_	C		A

0.25
 / \
0.1	0.15
B	D

0.25
 / \
0.1	0.15
B	D

0.35
 / \
0.15	0.2
_	C

0.4
A

Final Huffman code table:

character	A	B	C	D	$\overline{}$
probability	0.4	0.1	0.2	0.15	0.15
codeword	0	100	111	101	110

b. With the code of part a, the text ABACABAD will be encoded as 0100011101000101.

c. With the code of part a, the code 100010111001010 will be decoded as BAD_ADA.

Implementation: Here

Result of implementation:

```
Huffman code table:
A -> 0
B -> 100
C -> 111
D -> 101
_ -> 110
String to encode: ABACABAD
Encoded string: 0100011101000101
String to decode: 100010111001010
Decoded string: BAD_ADA
```