Assignment 16

1) "It was the age of wisdom It was the age of foolishness"

(54 characters) array will look like:
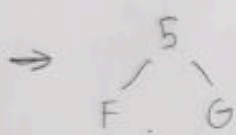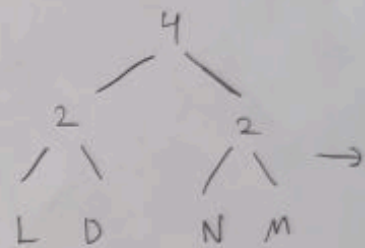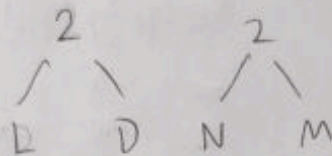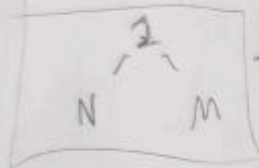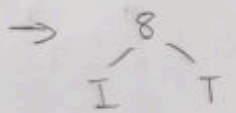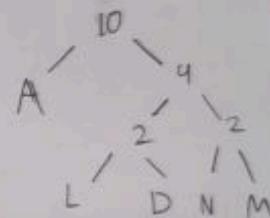
Sp	S	E	O	A	I	T	F	H	W	G	D	L	M	N
11	6	5	5	4	4	4	3	3	3	2	1	1	1	1

Building Tree:
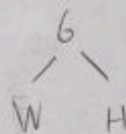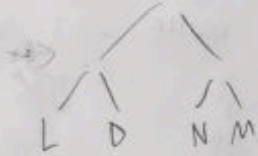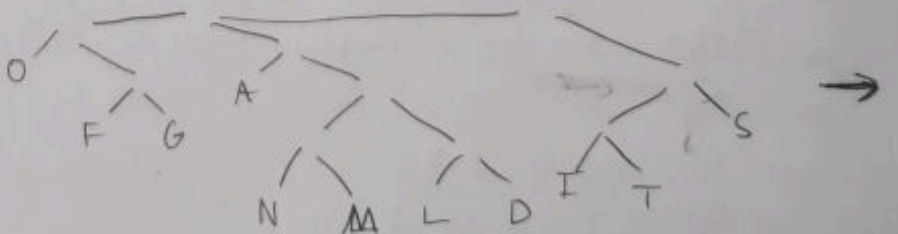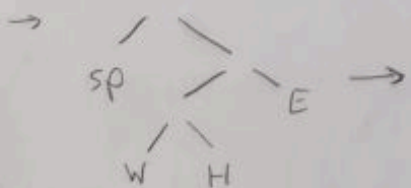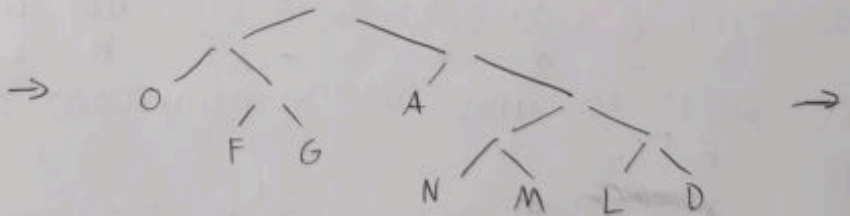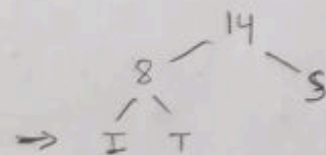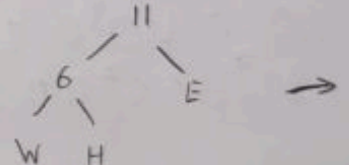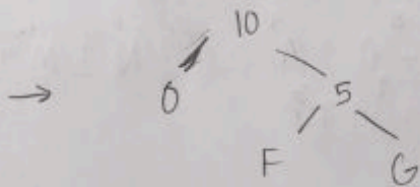
→ Final Huffman tree:
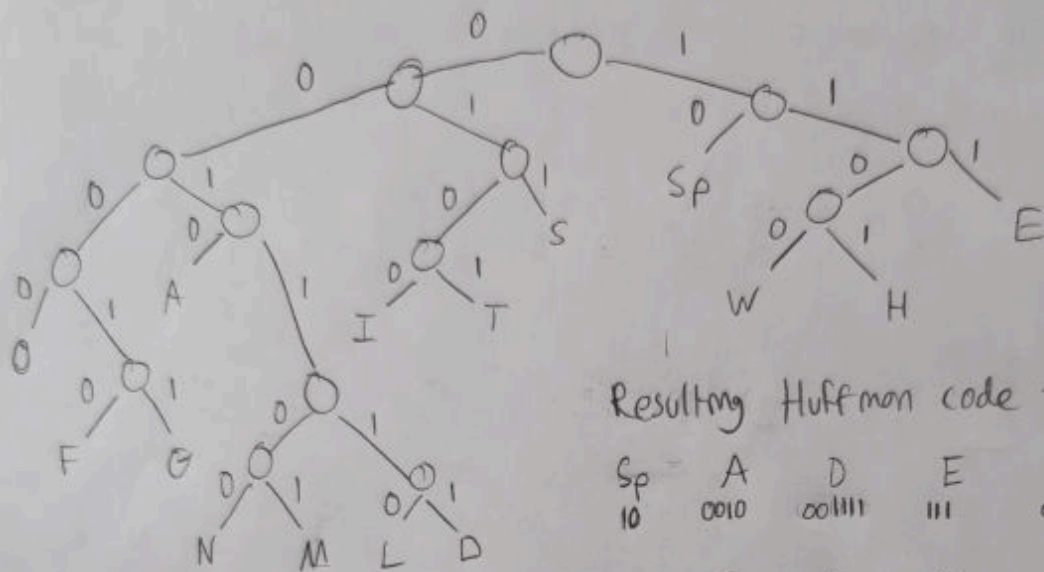
Resulting Huffman code table:

Sp	A	D	E	F	G
10	0010	001111	111	00010	00011

H	I	L	M	N	O
1101	0100	001110	001101	001100	0000

S	T	W			
011	0101	1100			

Compressed bitstream:

00001 (O) 0 1 (F) 1 (G) 0 1 (A) 0 0 1 (N) 1 (M) 1 (L) 1 (D) 0 0 1 (I) 1 (T)
1 (S) 0 1 (Sp) 0 0 1 (W) 1 (H) 1 (E)

encoding:

```
0100  0101 10 1100 0010 011 10 0101  1101 111 10 0010 00011 111 10
  I     T   -   W    A   S   -   T    H    E   -   A    G     E  -
0000  00010 10 1100 0100 011 00111 0000 001101 10 0100 0101
  O     F   -   W    I    S    D     O     M     -   I    T
10 1100 0010 011 10 0101 1101 111 10 0010 00011 111 10 0000  000 10
 -   W    A   S   -   T    H    E   -   A    G     E   -   O     F
10 00010 0000 0000 001110  0100 011 1101 001100 111 011 011
 -   F    O    O     L       I   S    H    N      E   S   S
```

Bits for trie storage: 94   Original bits used: 54 × 7 = 378
Bits for string compression: 195
         Total: 289 bits

2) "It was the season of darkness, it was the spring of hope, it was the winter of despair"

(86 characters)

Sp	S	E	T	I	A	O	W	H	N	R	F	P	D	,	K	G
17	9	8	7	6	6	5	4	4	4	4	3	3	2	2	1	1

Building the:
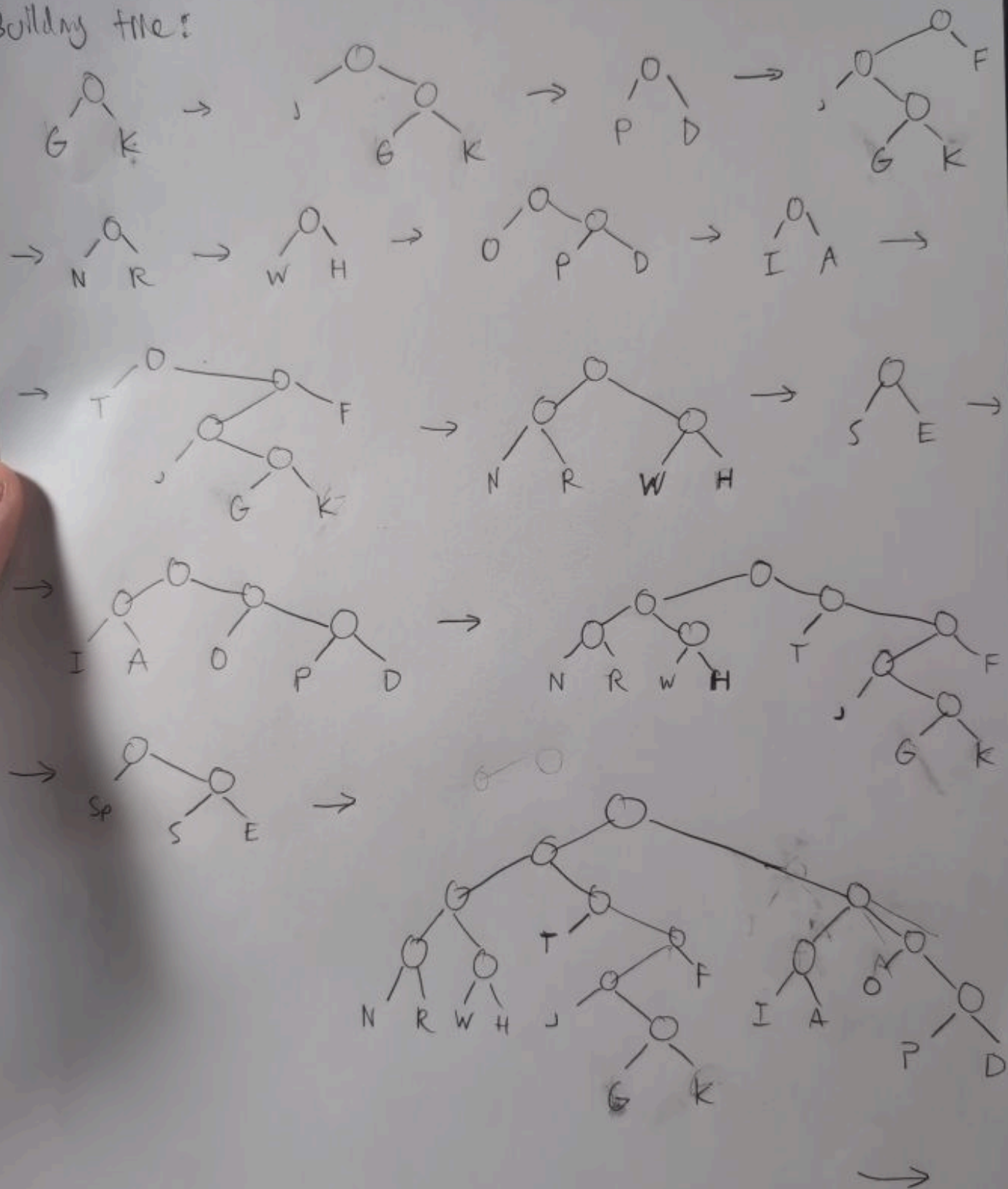
Final trie:
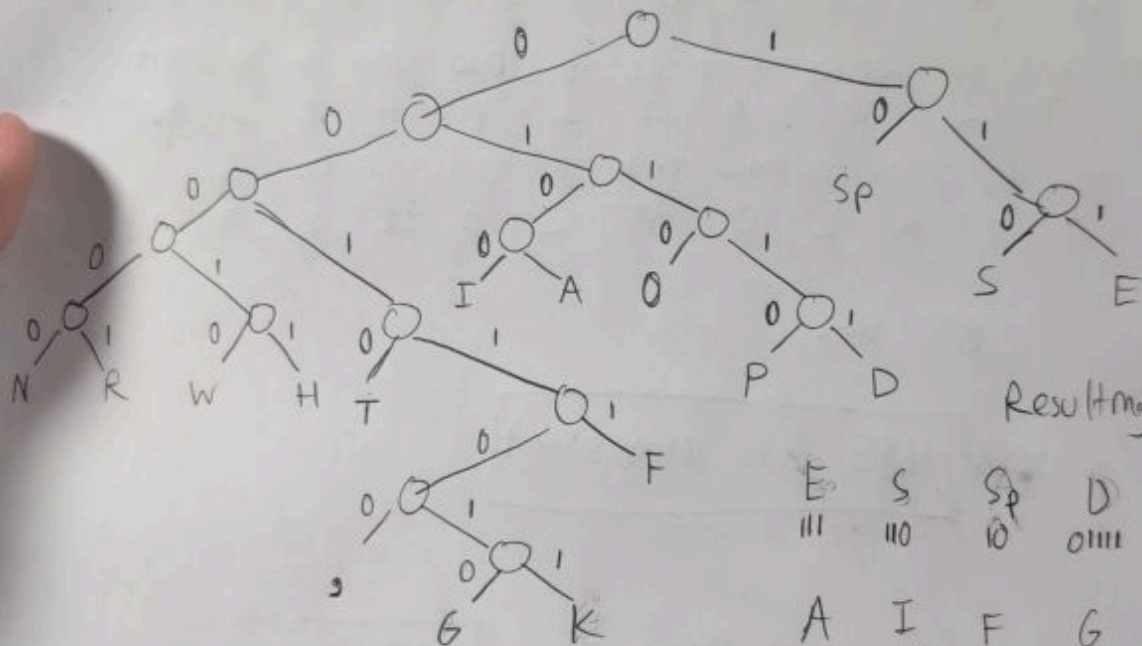
Resulting code table:

E	S	Sp	D	P	O
111	110	10	01111	01110	0110

A	I	F	G	K	,
0101	0100	00111	0011010	0011011	001100

T	H	W	R	N
0010	00011	00010	00001	00000

Compressed Bitstream:

0 0 0 0 0 1 (N) 1 (R) 0 1 (W) 1 (H) 0 1 (T) 0 0 1 (,) 0 1 (G) 1 (K) 0 1 (F)
0 0 1 (I) 1 (A) 0 1 (O) 0 0 1 (P) 0 1 (Sp) 0 1 (S) 1 (E)

33

107 bits

encoding:

0100 0010 10 00010 0101 110 10 0010 00011 111 10 110 111 0101 110 0110
I   T   _ W   A   S   _ T   H   E   _ S   E   A   S   O

00000 10 0110 0O111 10 01111 0101 00001 0011011 00000 111 110 110 001100
N   _ O   F   _ D   A   R   K   N   E   S   S   ;

10 0100 0010 10 00010 0101 110 10 0010 000 11 111 10 110 01110
_ I   T   _ W   A   S   _ T   H   E   _ S   P

00001 0100 00000 0011010 10 0110 00111 10 00011 0110 01110 111 001100
R   I   N   G   _ O   F   _ H   O   P   E   ;

10 0100 0010 10 00010 0101 110 10 0010 00011 111 10 00010 0100
_ I   T   _ W   A   S   _ T   H   E   _ W   I

00000 0010 111 00001 10 0110 00111 10 01111 111 110 01110 0101 0100
N   T   E   R   _ O   F   _ D   E   S   P   A   I

00001
R   388 bits

107 + 388 = 495 bits compressed

Original bits used: 86 × 7 = 602 bits