HW3 12741. Ming Xu; mxu2

Coding "she sells seashells on the seashore" into bits

a) s, h, e, l, space, o, n, t, r, a. (m = 10)

b) n = 4 (2^n ≥ m)

map	
a	0000
e	0001
h	0010
l	0011
n	0100
o	0101
r	0110
s	0111
t	1000
space	1001

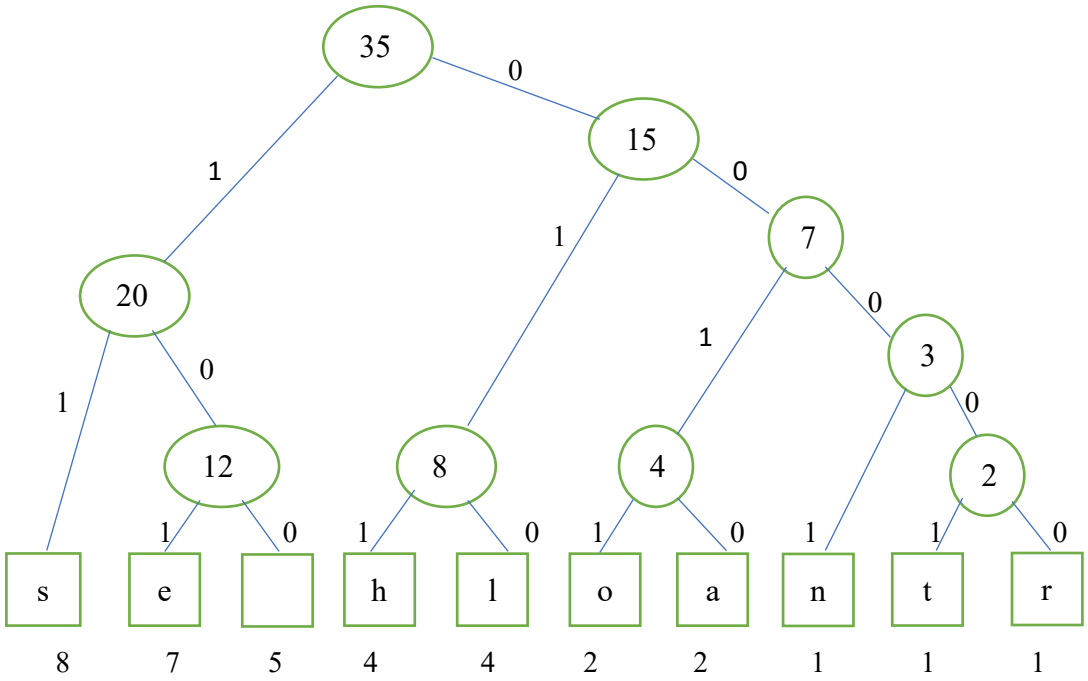
c) report the bit code for the entire sentence

0111 0010 0001 1001 0111 0001 0011 0011 0111 1001 0111 0001 0000 0111 0010 0001 0011 0011
0111 1001 0101 0100 1001 1000 0010 0001 1001 0111 0001 0000 0111 0010 0101 0110 0001

d)

frequency of occurrence	
s	8
e	7
space	5
h	4
l	4
o	2
a	2
n	1
t	1
r	1

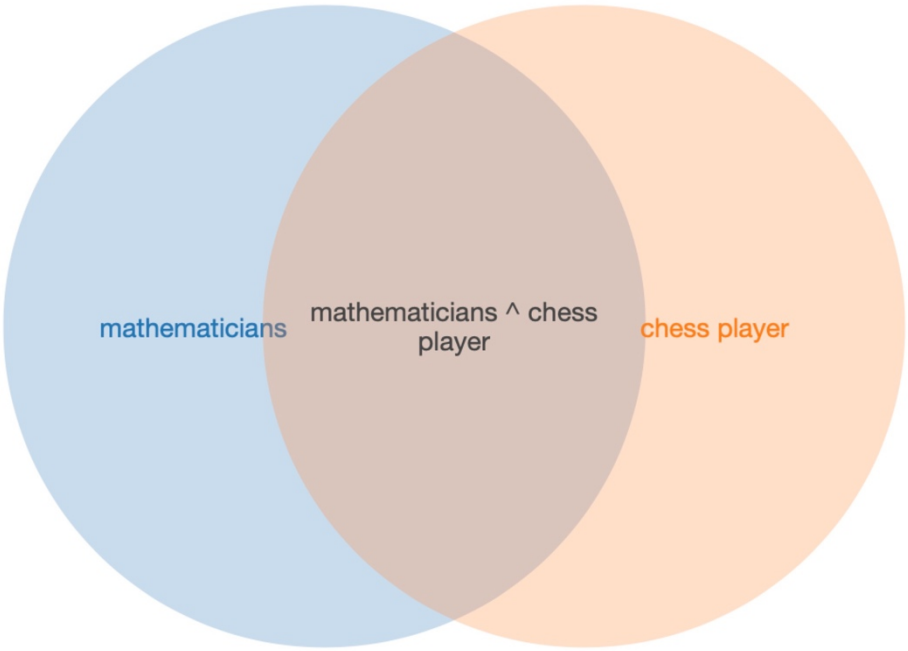
e)



map	
a	0010
e	101
h	011
l	010
n	0001
o	0011
r	00000
s	11
t	00001
space	100

f)
11 011 101 100 11 101 010 010 11 100 11 101 0010 11 011 101 010 010 11 100 0011 0001 100 00001 011 101 100 11 101 0010 11 011 0011 00000 101
g)
compression rate = 140/106 = 1.32

2.



a) Definitely, youngest chess player among mathematicians and youngest mathematician among chess players are the same people. For the youngest chess player among mathematicians these chess players are subset of mathematicians and for youngest mathematician among chess players, these mathematicians are subset of chess players. So, for those people both can play chess and know mathematicians are the intersection of set chess player and set mathematician.

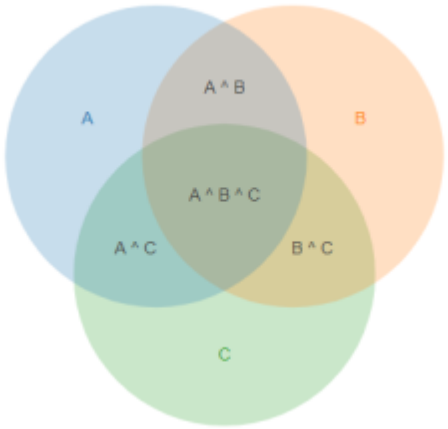
b) Also, the question is quite similar as question a), best chess player among mathematician and the best mathematician. For the best chess player among mathematicians these chess players are subset of mathematicians and for best mathematician among chess players, these mathematicians are subset of chess players. So, for those people both can play chess very well and know mathematicians very well are the intersection of set chess player and set mathematician.

c) Set 1 = mathematician
Set 2 = chess player
Set 1 and Set 2 ‘s intersection = person is both mathematician and chess player
Let me assign value x to set 1 and set 2, so the value of set 1 = 6x, and the value of set 2 =10x.
So, set2 (chess player) = 10x is larger than set 1(mathematician). The ratio of Set2/Set1 = 10/6=5/3

d) Set A = measures collected in 2017; Set B = measures collected on one level. Set U is the universal set. n(A) = 110, n(b) = 70 n(U) = 250

First, if set A have no intersection with set B, $A^c \cup B^c$ = 220 != Set U =250, So, Set A have intersection with Set B. $A^c \cup B^c$ = 220 , So $n(A \cap B)$ =250 – 220 = 30. n(measures collected in 2017 or level one) = n(Set A only contain measures in 2017) + n(Set B only contain measures for level one) = (110 – 30) + (70 - 30) =120.

e)



https://www.meta-chart.com/venn#/display This is the website I created my Venn drawing.

i) true

$(A \cap B) \cup C = (A \cap B) + (A \cap B \cap C) + (A \cap C) + (B \cap C) + C$

$(A \cup C) \cap (B \cup C) = (A \cap B) + (A \cap B \cap C) + (A \cap C) + (B \cap C) + C$

ii) true

$(A \cup B) \cap C = (A \cap C) + (B \cap C) + (A \cap B \cap C)$

$(A \cap C) \cup (B \cap C) = (A \cap C) + (B \cap C) + (A \cap B \cap C)$

iii) false

$(A \cup B) \setminus C = A + B - (A \cap C) - (B \cap C) - (A \cap B \cap C)$

$(A \setminus C) \cup B = A - (A \cap C) - (A \cap B \cap C) - (A \cap B) + B$

iv) true

$(A \cap B) \setminus C = (A \cap B)$

$(A \setminus C) \cap B = (A \cap B)$

v) true

$A \setminus (B \cup C) = A - (A \cap B \cap C) - (A \cap B) - (A \cap C)$

$(A \setminus B) \cap (A \setminus C) = A - (A \cap B \cap C) - (A \cap B) - (A \cap C)$

vi) true

$A \setminus (B \cap C) = A - (A \cap B \cap C)$

$(A \setminus B) \cup (A \setminus C) = A - (A \cap B \cap C)$

3.

a) the measures collected in 2017,

mean = average of the measures in 2017 in Excel using function AVERAGE, we get mean = 2.169230769

I use STDEV()function to calculate measures in 2017 = 0.29264488

2. the measures collected on level 3,
mean = average of the measures on level 3 in Excel using function AVERAGE, we get mean = 2.266666667
I use STDEV()function to calculate measures in 2017 = 0.703562364
3, the measures collected in 2017 on level 3
mean = average of the measures in 2017 on level 3 in Excel using function AVERAGE, we get mean = 2.33333333
I use STDEV()function to calculate measures in 2017 = 0.251661148

b) Compute the minimum of
the measures in 2017
I use the MIN () function in Excel to compute minimum value of measures in 2017 = 1.7
The measures on level 3
I use the MIN () function in Excel to compute minimum value of measures on level 3 = 1.1
The measures on level 3 and in 2017
I use the MIN () function in Excel to compute minimum value of measures on level 3 and in 2017 = 2

c) for any possible set of measures:
i. The minimum of “the measures collected in 2017” is less or equal than “the measures collected in 2017 on level 3”.
The set (2017 and level 3) = {2.2, 2, 2.5}
The set (2017) ={1.8, 1.9, 1.7, 2.1, 2.3, 2.2, 2.5, 1.9,2, 2.3,2.6,2.4,2.5}
The set (2017 and level 3) is a subset of set (2017). So, the minimum value of set {2017} is always smaller than the measures collected in 2017 on level 3. (True)

ii. The average of “the measures collected in 2017 on level 3” is between the average of “the measures collected on level 3” and that of “the measures collected in 2017”.
(False)
Let me show you an example Set(2017 on level 3) ={2}; Set (level 3)={2,2.8}; Set(2017) ={2,2.6}
Mean of set(2017 and level3) = 2; Mean of set(level3) = (2+2.8)/2 = 2.4; Mean of set(2017) = (2+2.6)/2 = 2.3. So, ii statement is not always true.