COS10003 COMPUTER-LOGIC ESSENTIALS

ASSIGNMENT 2 LOGIC AND SETS

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Question 1:

Considering:

We have a total of 465 students is defined as — Set U (Universe)

We have a total of 101 students did not join any activities

>> The total of students did join at least one activity is:

465 – 101 = 364 (students)

(A ∪ **B** ∪ **C)**

In the set of total students, there are:

- Set of students joined a student club is — Set A
- Set of students ate at a cafe is — Set B
- Set of students went to a gym is — Set C

Set of students joined club and ate at coffee is — A ∩ B

Set of students joined club and went to gym is — A ∩ C

Set of students joined club ate at coffee and went to gym is — A ∩ B ∩ C

a) According to question we didn't know the total of students ate at coffee and went to the gym.
>> So the total of students ate at coffee and went to gym is the missing value.

Considering that set is B ∩ C as x

According to the Fundamental laws and Inclusion/Exclusion techniques, we have the formula:

| A U B U C | = |A| + |B| + |C| - |A ∩ B| - |A ∩ C| - |B ∩ C| + |A ∩ B ∩ C|

↔ | A U B U C | = |A| + |B| + |C| - |A ∩ B| - |A ∩ C| - **x** + |A ∩ B ∩ C|

↔ **x** = |A| + |B| + |C| - |A ∩ B| - |A ∩ C|+ |A ∩ B ∩ C| - | A U B U C |

↔ **x** = 220 + 159 + 208 - 68 – 126 + 32 - 364

↔ **x** = 61 (students)

Answer: There are 61 students ate at the coffee and went to gym.

b)

- Students joined school club and ate at coffee but not went to gym:

x + 32 = 68

x = 68 - 32

x = 36 (students)

- Students joined school club and went to gym but not ate at coffee:

y + 32 = 126

y = 126 - 32

y = 94 (students)

- Students ate at coffee and went to gym but not joined school club:

y + 32 = 61

y = 61 - 32

y = 61 - 32 = 29 (students)

- Students only joined school club:

a + 32 +36 +94 = 220

a = 220 – 32 -36 -94

a = 58 (students)

- Students only ate at coffee:

b + 32 + 36 +29 = 159

b = 159 -36 - 32 - 29

b = 62 (students)

- Students only went to gym:

c + 94 + 32 +29 = 208

c = 208 – 94 – 32 - 29

c = 53 (students)

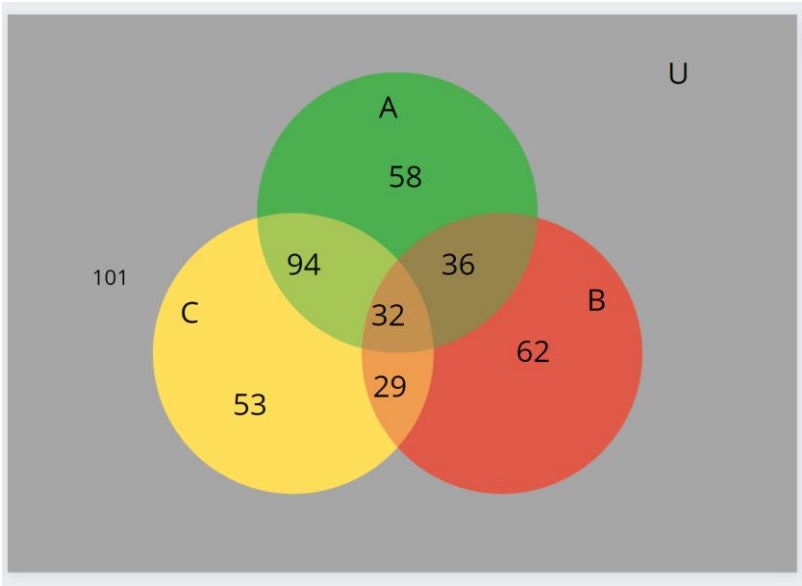


Diagram about student activities

c)

i. Did not go a gym (could both join student club and ate at a coffee)

>> x = 58 +36 +62 + 101

>> x = 257 (students)

Answer: There were 156 students do not go to gym.

ii. Joined student club but did not eat at a coffee

>> x = 58 + 94

>> x = 152 (students)

Answer: There were 152 students join student club but did not eat at a coffee.

iii. Did one only of joined a student club, eat at a cafe or went to a gym.

>> x = 58 + 53 + 62

>> x = 173 (students)

Answer: There were 173 students did one join student club, eat at a coffee or went to a gym.

d)

i. Did not go to a gym nor eat at a cafe.

Answer: (B ∪ C)'

ii. Joined a student club and ate at a cafe but did not go to a gym.

Answer: C' ∪ (A ∪ B)

Question 2:

a: Adita plays esports

d: David plays esports

h: Huyen plays cricket

a)

i. $h \wedge (d \vee a)$

Answer: Huyen plays cricket and Adita or David plays esports

ii. $d \rightarrow \neg a \vee h$

Answer: If David plays esport, then Adita could not play esport or Huyen could play cricket

iii. $\neg (h \vee d)$

Answer: Neither Huyen play cricket nor David play esport.

b)

i. If David plays esports, then Adita plays esports.

Answer: $d \rightarrow a$

ii. Neither Adita nor David play esports.

Answer: $\neg(a \vee d)$

iii. Adita plays esports if and only if Huyen plays cricket and David plays esports.

Answer: a ↔ (h Λ d)

Question 3:

Considering that:

Height <= 100 is **a**

Weight > 10 is **b**

Statement: (a V b) Λ (¬a V b) Λ a

Associative law: (a V b) Λ a Λ (¬a V b)

Absorption law: a Λ (¬a V b)

Domination law: a Λ b (what need to prove)

Question 4:

We have: relation S on Z x Z where Z = { a; b; c; d; e}

S = {(a; a); (b; b); (a; b); (b; a); (c; c); (d; d); (e; e); (c; e); (d; e); (e; c); (e; d)}

A equivalence relation depends on 3 properties: reflective, symmetric and transitive.

Answer:

Reflectivity: A = {(a, a); (b, b); (c, c); (d, d); (e, e}

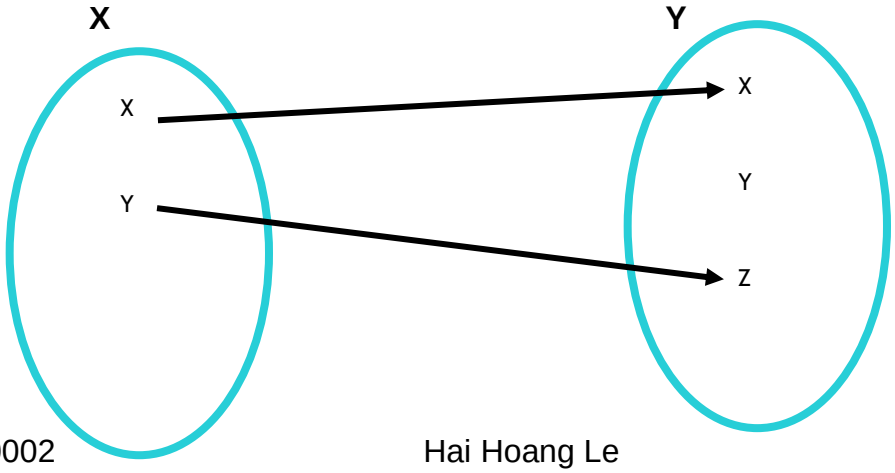
Symmetric: B = {(a, b); (b, a); (c, e); (e, c); (e, d); (d, e)}

Transitive: we could have (c, e) and (e, d), but (c, d) $\notin S$ so $C = \emptyset$

Question 5:

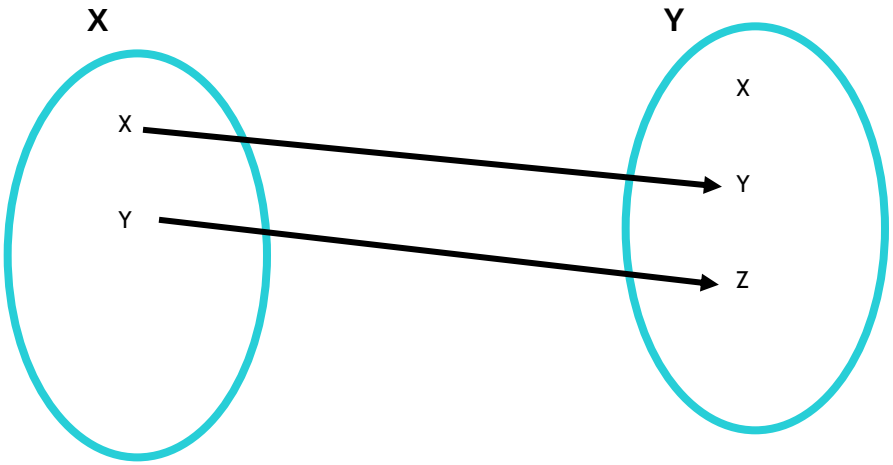
We have the domain X = { x, y} and co-domain Y = {x, y, z}:

a) Possible function f : X → Y



Answer: There are 2 possible function f: X → Y

b) Possible injective function



Answer:
There are two possible functions that is infective function

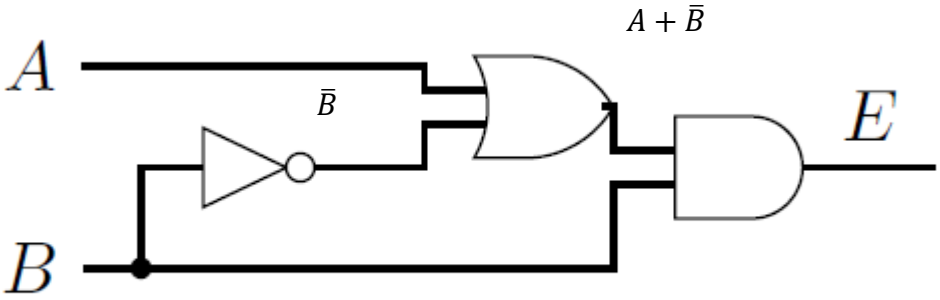
Example of injective function (one to one function): {(x, y); (y,z)}

Example of not injective function: {(x, y); (x,z)}

c) Possible bijective function

Answer:
In this case there are any bijective functions because domain X has 2 values and the range Y has 3 values which means that there is one value won't be used.

Question 6:
a) i.

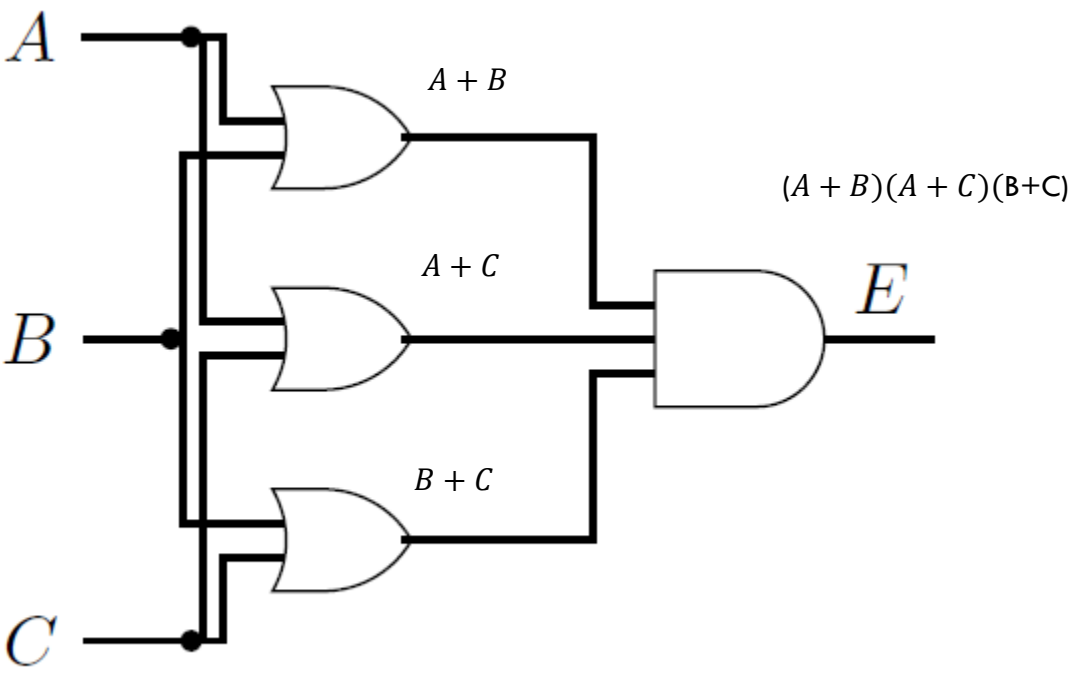


ii.

A	B	$\bar{B}$	$A + \bar{B}$	E = $B(A + \bar{B})$
1	**1**	**0**	**1**	**1**

b)

i.

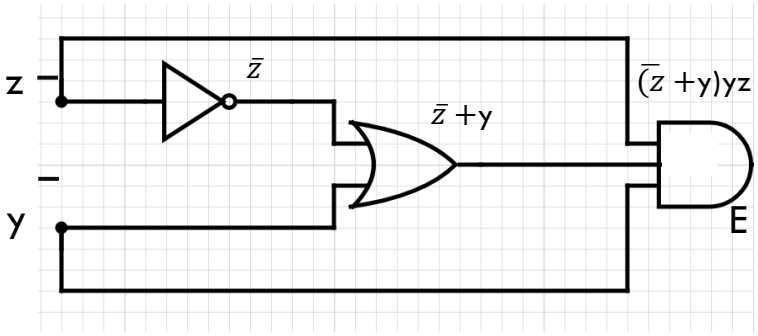


ii.

A	B	C	A + B	A + C	B + C	E = $(A + B)(A + C)(B+C)$
1	1	0	1	1	1	1

Question 7

a) E = (z’ + y) y z

b) 

E = (z’ + y) y z

Distributive law: E = (yz’ + yy)z
Idempotent law: E = (yz’)z
Distributive law: E = yzz’
Complement law: E = yz

Answer E = yz

c) Answer:
Original circuit: Size = 3, Depth = 3
Simplified circuit: Size = 1, Depth = 1