ASSIGNMENT

Course Code	CSC201A
Course Name	Discrete Mathematics -1
Programme	B. Tech
Department	Computer Science & Engineering
Faculty	Faculty of Engineering Technology

Name of the Student	KAUSHAL VASHISTH
Reg. No	18ETCS002147
Semester/Year	3RD / 2019
Course Leader/s	Ms Sahana P. Shankar

Declaration Sheet			
Student Name	KAUSHAL VASHISTH		
Reg. No	18ETCS002147		
Programme	B. Tech	Semester/Year	3rd / 2019
Course Code	CSC201A		
Course Title	Discrete Mathematics -1		
Course Date		To	
Course Leader	Ms Sahana P. Shankar		

Declaration

The assignment submitted herewith is a result of my own investigations and that I have conformed to the guidelines against plagiarism as laid out in the Student Handbook. All sections of the text and results, which have been obtained from other sources, are fully referenced. I understand that cheating and plagiarism constitute a breach of University regulations and will be dealt with accordingly.

Signature of the Student		Date	
Submission date stamp (by Examination & Assessment Section)			

Signature of the Course Leader and date	Signature of the Reviewer and date

Engineering and Technology			
Ramaiah University of Applied Sciences			
Department	Computer Science and Engineering	Programme	B. Tech.
Semester/Batch	3rd/2019		
Course Code	CSC201A	Course Title	Discrete Mathematics-1
Course Leader(s)	Ms Sahana P. Shankar and Ms.Supriya		

Questions	Marking Scheme		Marks		
			Max Marks	First Examiner Marks	Moderator
1	1.1	Development of a Python program with comments to create sets and perform the specified operations	5		
	1.2	Illustration using Venn diagrams	2		
		Question 1 Max Marks	**7**		
2	2.1	Justification of the statement with appropriate reasoning	2		
	2.2	Solution to the example problem	1		
		Question 2 Max Marks	**3**		
		Total Assignment Marks	**10**		

Course Marks Tabulation				
Question	**First Examiner**	**Remarks**	**Moderator**	**Remarks**
1				
2				
Marks (Max 10)				

Signature of First Examiner **Signature of Moderator**

Q1:- *Python program with comments to create sets and perform the specified operations:-*

```python
choice=int(input(
"enter :-1 for string input in set and enter: 2 for integer input:- "))
if(choice==1):
    #inputing n elements of set a and set b:-
    a=set(list(input("enter values of set a :- ").split()))
    b=set(list(input("enter values of set b :- ").split()))
    #inputing universal set
    u=set(list(input("enter values of universal set :- ").split()))
    print("\n \t\t\t\t |---------------------------------------------|")
    print("\t\t\t\t |universal =",u)
if(choice==2):
    #inputing n elements of set a and set b:-
    a=set(map(int,input("enter elements of set a :  ").split()))
    b=set(map(int,input("enter elements of set b :  ").split()))
    #inputing the range of universal set:-
    x,y=map(int,input("enter range of universal set:- ").split())
    print("\n \t\t\t\t |---------------------------------------------|")
    #let the unversal set be x to y
    u={i for i in range(x,y+1)}
    print("\t\t\t\t |universal =",u)
```

```python
#run loop in set a and if element of 'a' is present in b then :- put it in 'inter' set.
#then it will give us intersection
inter={i for i in a if i in b}
print("\t\t\t\t |intersection =",inter)
#run loop in set a and if element of 'a' is not present in b then:- put it in diff set
#then it will give us difference a-b
diff1={j for j in a if j not in b}
print("\t\t\t\t |difference(a-b) =",diff1)
#silmilarly b-a :-
diff2={j for j in b if j not in a}
print("\t\t\t\t |difference(b-a) =",diff2)
#add list of a and list of b then make set of addition to get unique elements
union=set(list(a)+list(b))
print("\t\t\t\t |union =",union)
#run loop in universal set and if element of u is not present in 'a' then:- put it in comp_a set
#then it will give us compliment of 'a'
comp_a={k for k in u if k not in a}
print("\t\t\t\t |compliment of a =",comp_a)
#similarly
comp_b={k for k in u if k not in b}
print("\t\t\t\t |compliment of b =",comp_b)
print(" \t\t\t\t |---------------------------------------------|\n")
```

```python
#plotting venn diagrams
import matplotlib.pyplot as plt
from matplotlib_venn import venn2

print("VENN DIAGRAMS REPRESENTATION :--\n")
null=' '
print("1) Representation of set a and set b :- \n")
v1=venn2([a, b],('SET A','SET B'))
v1.get_label_by_id('11').set_text(inter)#shows intersection a&b
v1.get_label_by_id('10').set_text(diff1)#shows a-b
v1.get_label_by_id('01').set_text(diff2)#shows b-a
plt.show()
print("HERE,red = difference(a-b) brown = intersection(a&b) and green = difference(b-a) \n")

print("2) Representation of union of a and b:- \n")
v2=venn2([a, b],('SET A','SET B'))
v2.get_patch_by_id('11').set_color('skyblue')#common color to show union
v2.get_patch_by_id('01').set_color('skyblue')
v2.get_patch_by_id('10').set_color('skyblue')
v2.get_label_by_id('11').set_text(union)
v2.get_label_by_id('10').set_text(null)
v2.get_label_by_id('01').set_text(null)
plt.show()
print("HERE,the common color shows the union\n")

print("3) Representation of compliment of set a :- \n")
v3=venn2([a, u],('SET A','UNIVERSAL SET'))
v3.get_label_by_id('11').set_text(a)#shows a
v3.get_label_by_id('01').set_text(comp_a)#shows compliment
v3.get_label_by_id('10').set_text(null)
plt.show()
print("HERE, green = compliment of set a \n")

print("4) Representation of compliment of set b :- \n")
v4=venn2([b, u],('SET B','UNIVERSAL SET'))
v4.get_label_by_id('11').set_text(b)#shows b
v4.get_label_by_id('01').set_text(comp_b)#shows compliment
v4.get_label_by_id('10').set_text(null)
plt.show()
print("HERE, green = compliment of set b \n")
```

Output:-

Page turn over:-

Question No. 2

Solution to Question No. 2:

Definition

Mathematical Induction *is a mathematical technique which is used to prove a statement, a formula or a theorem is true for every natural number.*

The technique involves two steps to prove a statement, as stated below −

Step 1(Base step) *− It proves that a statement is true for the initial value.*

Step 2(Inductive step) *− It proves that if the statement is true for the n^{th} iteration (or number n), then it is also true for $(n+1)^{th}$ iteration (or number n+1).*

2.1 Justification of the statement with appropriate reasoning

Let s be a set and $p(s)$ be its power set.
i.e $p(s)$ is the set of all subsets of s.

To prove : if $|s| = n$ then $|p(s)| = 2^n$ (to be proven by mathematical induction)

Proof:-
Basic steps:-
If $n = 0$, then

s *must be* ϕ *and* $p(\phi) = \{\phi\}$

Hence,

$$|p(s)| = 2^0 = 1$$

If $n = 0$,

$$s = \{x\}$$
$$p(s) = \{\{x\}, \phi\}$$

Hence,

$$|p(s)| = 2^1 = 2$$

Induction step:-
Assume true for $n = k$, for any s with
cardinality of s:- $|s| = k$,
Then, $|p(s)| = 2^k$

Now, show true for $= k + 1$; consider s with $k + 1$ elements
So,

Picking an element $x \in s$

So, any subset of s either

1. *Contains x*
2. *Or doesn't contain x*

- *If $X \subseteq s$ and $x \notin s$ then*

$X \subseteq s\backslash\{x\}$ ($s\backslash\{x\}$ is a set excluding {x} also, it is a set with k elements)
So there are 2^k such subsets.

- *If $x \in X$ then $X\backslash\{x\}$ is a subset of $s\backslash\{x\}$*
  So again X is determined by a subset of $s\backslash\{x\}$
  So there are 2^k such subsets X

Total = $2^k + 2^k = 2.2^k = 2^{k+1}$
There fore,
For $n = k + 1$, there 2^{k+1} subsets of s.
Hence proved by mathematical induction

2.2 Example of above proof

Example Of set:-
Set1={1,2}
we know that cardinality of set1 is 2, therefore cardinality of power set should be $2^2 = 4$.
Power set of set1 is :-{{1},{2},{1,2}, ϕ}
Since cardinality of power set =4
Hence verified.

Other Example of mathematical induction:-

Use the Principle of Mathematical Induction to verify that, for n any positive integer, 6n −1 is divisible by 5.

For any n ≥ 1, let Pn be the statement that 6n − 1 is divisible by 5.
Base Case. The statement P1 says that

$$6^1 - 1 = 6 - 1 = 5$$

is divisible by 5, which is true.

Inductive Step. Fix k ≥ 1, and suppose that P_k holds, that is, $6^k - 1$ is divisible by 5. It remains to show that P_{k+1} holds, that is, that $6^{k+1} - 1$ is divisible by 5.

$$\begin{aligned} 6^{k+1} - 1 &= 6(6^k) - 1 \\ &= 6(6^k - 1) - 1 + 6 \\ &= 6(6^k - 1) + 5. \end{aligned}$$

By P_k, the first term $6(6^k - 1)$ is divisible by 5, the second term is clearly divisible by 5. Therefore the left hand side is also divisible by 5. Therefore P^{k+1} holds.

Thus by the principle of mathematical induction, for all n ≥ 1, P_n holds.