JIS College of Engineering
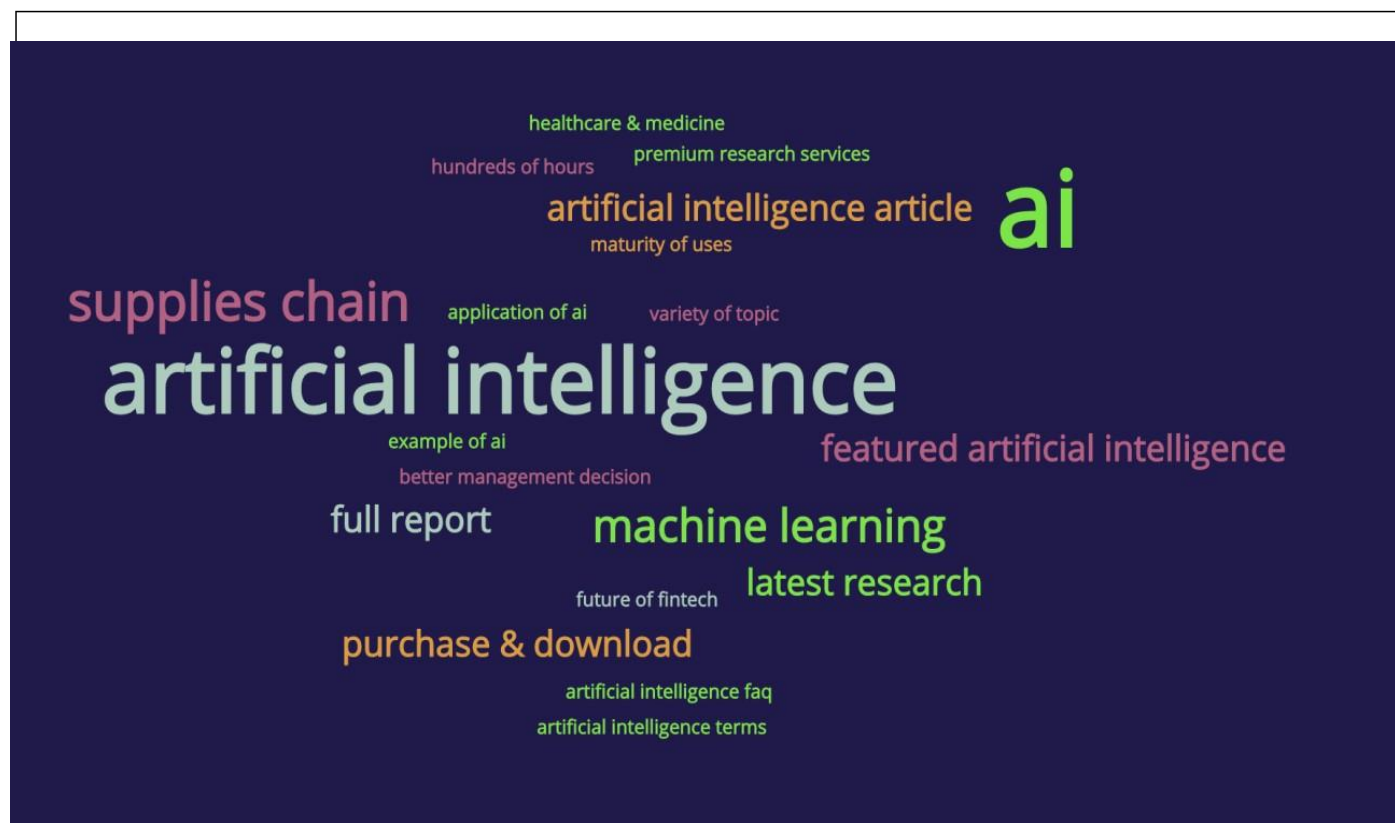## Department of Computer Science and Engineering
Paper Name: Artificial Intelligence Lab
Paper Code: CS 791A

Name	ANUPAM DUTTA
University Roll Number	123200803202
University Registration Number	201230100120002-(2020-2021)
Section	B
Group	2
Mobile Number	9163142597 / 8910069724
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Vision and Mission of the Department: -

Vision

The Computer Science and Engineering Department at JIS College of Engineering will be a leader in computing innovation through excellence in undergraduate and graduate education, active research programs and the dissemination of knowledge. The Department will leverage both the international and interdisciplinary nature of computing.

Mission

The Department's mission is

- To provide students and faculty with an open environment that encourages professional and personal growth.

- To prepare students for flexible career paths and continuing advancement in computing.

- To motivate and encourage the students to build successful career in the computing professions through flexible program of study that can be adapted to support individual career goals.

Department Program Educational Objectives (PEOs)

The Program Educational Objectives (PEO) of the Mechanical Engineering Program will demonstrate the essential components of a successful engineer for the best career based professional accomplishments after graduation. Therefore, the objectives are following:

PEO 1: Graduates will be engineering practitioners and leaders, who would assist to resolve industry's technological problems.

PEO 2: Graduates will be engineering professionals, innovators or entrepreneurs engaged in technology development, technology deployment, or engineering system implementation in industry and research institute.

PEO 3: Graduates will interact with their peers in other disciplines in industry and society and contribute to social awareness and the economic growth of the country.

PEO 4: Graduates will be successful in pursuing higher studies in engineering or management and will pursue career paths in teaching or research.

JIS College of Engineering
Department of Computer Science and Engineering
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# Program Specific Outcomes (PSOs)

A graduate of the Computer Science and Engineering Program will demonstrate:

PSO1: Professional Skills: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

PSO2: Problem-Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

PSO3: Successful Career and Entrepreneurship: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies and research.

Course Objective(s):

- To learn the fundamentals of PROLOG/ LISP Programming.

- To impart adequate knowledge on the need of PROLOG/ LISP programming languages and problem-solving techniques.

Course Outcomes (COs):

CO1 To learn the concept of simple programming using PROLOG/ LISP.

CO2 To understand the concept of AI based programs using PROLOG/ LISP.

CO3 To develop the capability to represent various real life problem domains using logic-based techniques.

JIS College of Engineering
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Paper Name: Artificial Intelligence Lab
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CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	-	-	-	-
CO2	2	2	3	2	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	3	2

JIS College of Engineering
Department of Computer Science and Engineering
Paper Name: Artificial Intelligence Lab
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		INDEX			
Sl. No.	Name of the Experiment	Date of Experiment	Date of Submission	Signature	Remarks
1	Write a program in PROLOG to find the maximum of three numbers.				
2	Write a program in PROLOG to calculate the factorial of a number.				
3	Write a program in PROLOG to calculate the GCD of two numbers.				
4	Write a program in PROLOG to generate the Fibonacci series				
5	Write a program in PROLOG to count the number of elements in a list				
6	Write a program in PROLOG to insert an element at the beginning/ middle/ end of a list				
7	Write a program in PROLOG to find the GCD of the elements of a list				
8	Write a program in PROLOG to find the maximum of a list.				
9	Write a program in PROLOG to reverse a list.				
10	Write a program in PROLOG to check whether a number or string is a palindrome or not				
11	Write a program in PROLOG to delete an element from a list				
12	Write a program in PROLOG for linear search/ binary search in a list.				
13	Write a program in PROLOG to sort n numbers using the bubble sort algorithm				
14	Write a program in PROLOG for Towers of Hanoi problem				
15	Write a program in PROLOG for 4-Queens problem				
16	Write a Prolog Program to find the sum of inverse of N numbers				
17	Write a Prolog Program to find sum of first N natural numbers.				
18	Write a Prolog Program to find the square root of a number using function.				

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Department of Computer Science and Engineering
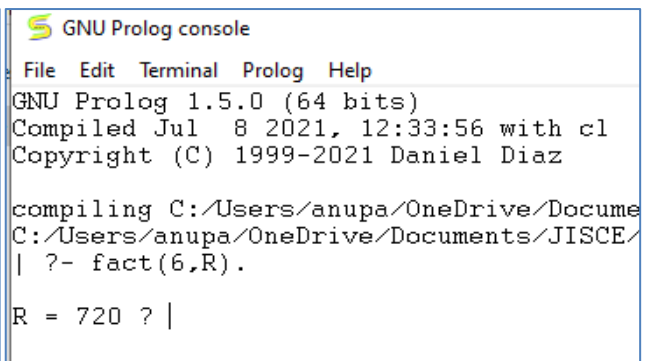## Paper Name: Artificial Intelligence Lab
Paper Code: CS 791A

	INDEX				
Sl. No.	Name of the Experiment	Date of Experiment	Date of Submission	Signature	Remarks
19	Write a Prolog Program to find the modulus of two numbers using function				
20	Write a Prolog Program to find the positive negative or zero				
21	Write a Prolog Program to find even odd using function				
22	Write a Prolog Program to print N to 20 using for loop (Fixing the end value).				
23	Write a Prolog Program to print N to 20 numbers using for loop, in reverse order				
24	Write a Prolog Program to print N to M numbers using for loop.				
25	Write a Prolog Program to find whether the number is present in list or not				
26	Write a Prolog Program to find the length of the list				
27	Write a Prolog Program to find multiplication of all list members				
28	Write a Prolog Program to append a new list to another list				
29	Write a Prolog Program to find sum of all list members.				

JIS College of Engineering
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Paper Name: Artificial Intelligence Lab
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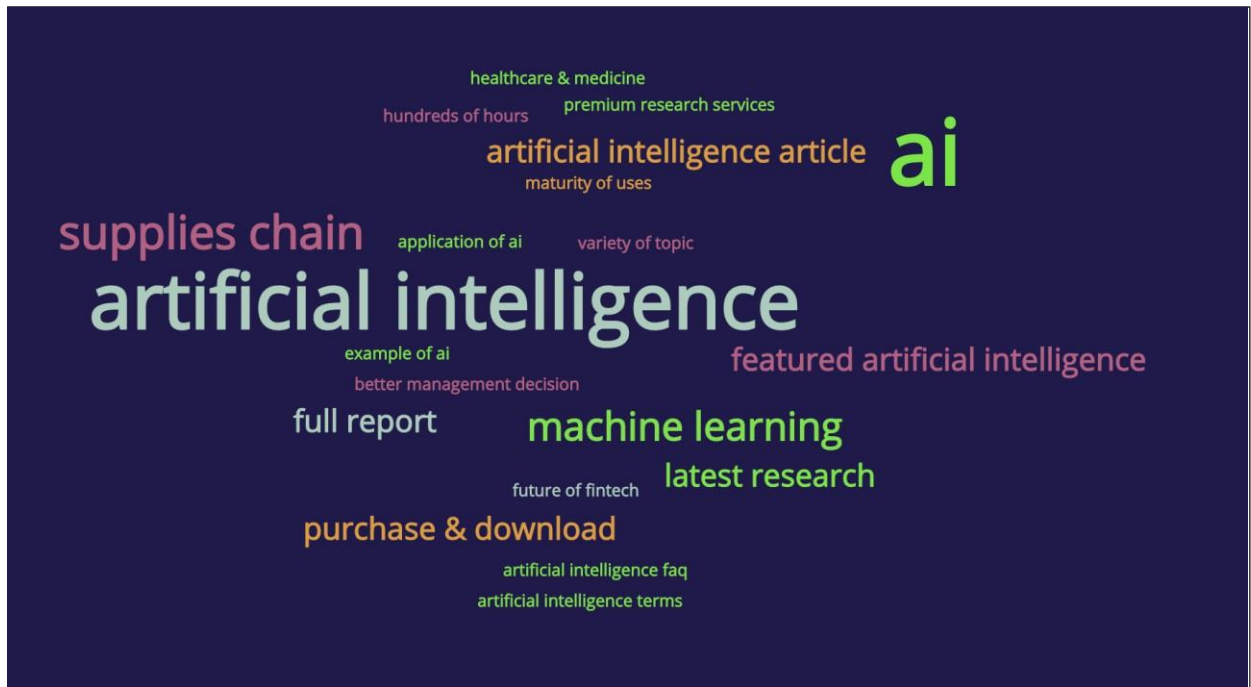
Name	Anupam Dutta
University Roll Number	123200803202
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Group	2
Mobile Number	9163142597 / 8910069724
Email Id	anupamdutta27121998@gmail.com

1. Write a program in PROLOG to find the maximum of three numbers.

Answer:-

```
max(P,Q,R):-P>Q,P>R,write('Larger number is '),write(P).
max(P,Q,R):-P<Q,Q>R,write('Larger number is '),write(Q).
max(P,Q,R):-R>Q,P<R,write('Larger number is '),write(R).
max(P,Q,R):-P=Q,P<R,write('Larger number is '),write(R).
max(P,Q,R):-P<Q,P=R,write('Larger number is '),write(Q).
max(P,Q,R):-Q=R,P>Q,write('Larger number is '),write(P).
max(P,Q,R):-P=Q,P>R,write('Larger numbers are  '),write(P),write(' and '),write(Q).
max(P,Q,R):-P=R,Q<R,write('Larger numbers are  '),write(P),write(' and '),write(R).
max(P,Q,R):-Q=R,P<R,write('Larger numbers are  '),write(R),write(' and '),write(Q).
max(P,Q,R):-P=Q,P=R,write('All numbers are equal ').
```
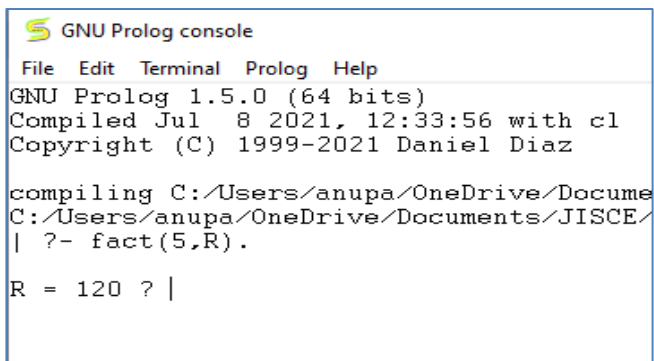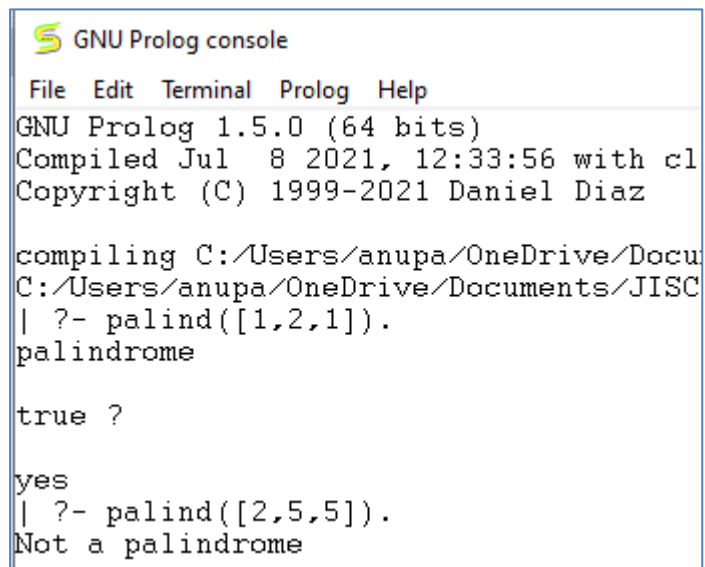
```
GNU Prolog console

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C:/Users/anupa/OneDrive/Documents/JISCE
| ?- max(1,2,3).
Larger number is 3

true ? |
```

```
true ? .
Action (; for next solutic

(46 ms) yes
| ?- max(7,10,50).
Larger number is 50

true ?

yes
| ?- |
```

2. Write a program in PROLOG to calculate the factorial of a number.

Answer:-

```
fact(0,1).
fact(N,F):- (
% The below is for +ve factorial. N>0 ->
(
N1 is N-1,
fact(N1,F1), F is N*F1
)
;

% The below is for -ve factorial. N<0 ->
(
N1 is N+1,
fact(N1,F1), F is N*F1
)
).
```
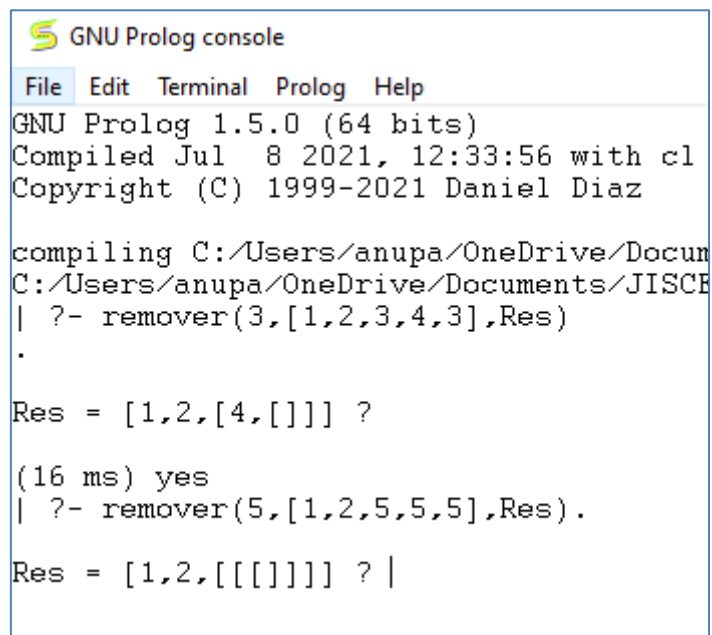
GNU Prolog console

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C:/Users/anupa/OneDrive/Documents/JISCE/
| ?- fact(5,R).

R = 120 ? |
```
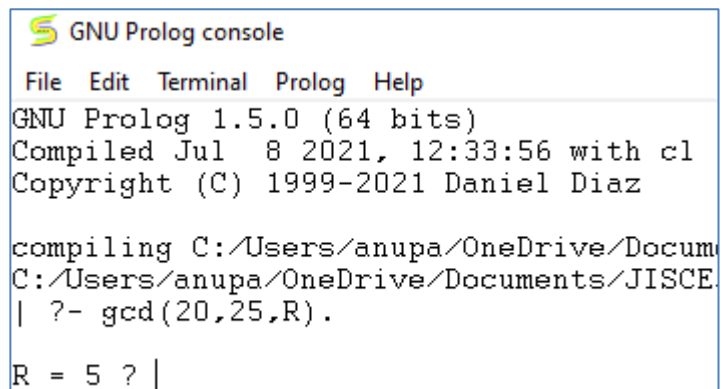
GNU Prolog console

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C:/Users/anupa/OneDrive/Documents/JISCE/
| ?- fact(6,R).

R = 720 ? |
```

3. Write a program in PROLOG to calculate the GCD of two numbers.

Answer-

```
gcd(X,0,X).
gcd(X,Y,Z):-
R is mod(X,Y),
gcd(Y,R,Z).
```

GNU Prolog console

File Edit Terminal Prolog Help

```
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C:/Users/anupa/OneDrive/Documents/JISCE
| ?- gcd(20,25,R).

R = 5 ?|
```
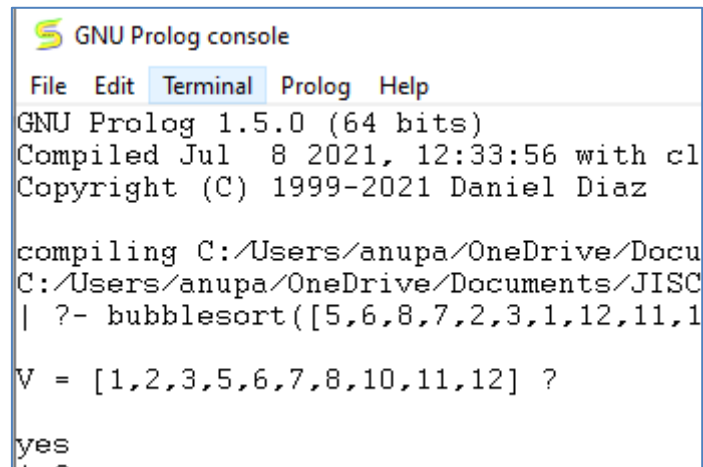
```
gcd(30,165,R).

R = 15 ?

yes
| ?- |
```

4. Write a program in PROLOG to generate the Fibonacci series.

Answer:-

fib(0, 1) :- !.
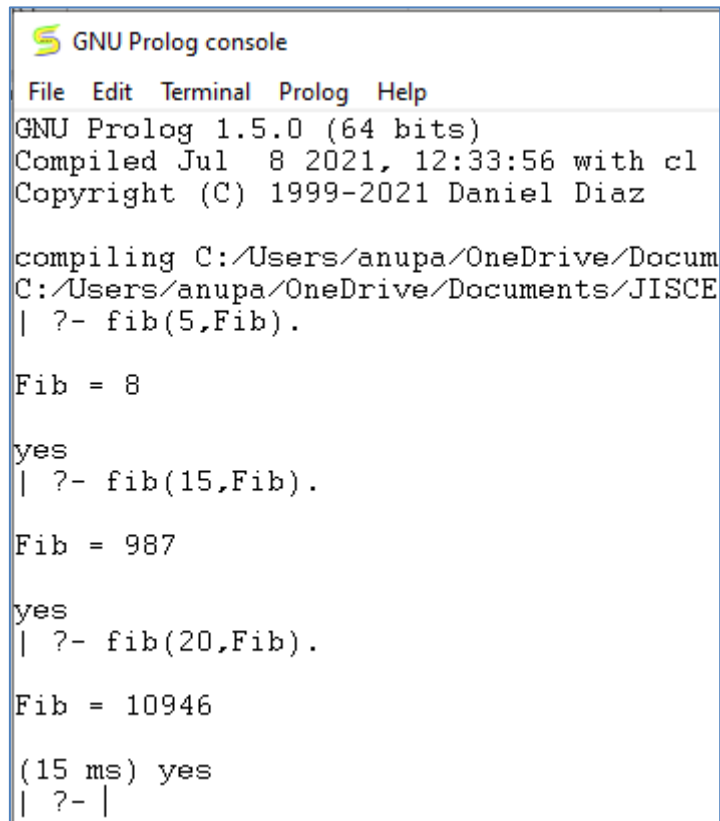
fib(1, 1) :- !.

fib(N, F) :-

N > 1,

N1 is N-1, N2 is N-2, fib(N1, F1),

fib(N2, F2), F is F1+F2.

5. Write a program in PROLOG to count the number of elements in a list.

Answer:-

count([],0).

count([_|Tail], N) :- count(Tail, N1), N is N1 + 1.

6. Write a program in PROLOG to insert an element at the beginning/ middle/ end of a list.

Answer-

Code For Insert At First Position-

insert_first(Item,List,[Item|List]).

```
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C:/Users/anupa/OneDrive/Documents/JISCl
| ?- insert_first(8,[5,2],V).

V = [8,5,2]

(16 ms) yes
| ?-
insert_first(10,[30,40],V).

V = [10,30,40]
```

Code For Insert At End Position-

insert_end(X,Y,Z):-

append(Y,[X],Z).

```
compiling C:/Users/anupa/OneDrive/Docume
C:/Users/anupa/OneDrive/Documents/JISCE/
| ?- insert_end(13,[11,12],V).

V = [11,12,13]

yes
| ?- insert_end(15,[13,14],V).

V = [13,14,15]

yes
| ?- |
```

7. Write a program in PROLOG to find the GCD of the elements of a list.

   Ans-

   ```
   gcd(0,X,X):- X > 0, !.
   gcd(X,Y,Z):- X>=Y, X1 is X -Y, gcd(X1,Y,Z).
   gcd(X,Y,Z):- X<Y, X1 is Y-X, gcd(X1,X,Z).
   gcdL([H,H1|T],Z):-gcd(H,H1,X),gcdL([X|T],Z).
   gcdL([H1,H2],Z):-gcd(H1,H2,Z).
   ```

   ```
   | ?- gcdL([75,25,5],V).

   V = 5 ?

   yes
   | ?- gcdL([12,16,20],V).

   V = 4 ?

   yes
   | ?- |
   ```

8. Write a program in PROLOG to find the maximum of a list.

   Answer:-

   ```
   list_max([P|T], O) :- list_max(T, P, O).
   list_max([], P, P).
   list_max([H|T], P, O) :- (H > P -> list_max(T, H, O);          list_max(T, P, O)).
   ```

   ```
   compiling C:/Users/anupa/OneDrive/Documents
   C:/Users/anupa/OneDrive/Documents/JISCE/SEM
   | ?- list_max([10,20,30,40,50,60,70],V).

   V = 70

   yes
   | ?- |
   ```

9. Write a program in PROLOG to reverse a list.

Answer-

list_concat([],L,L).
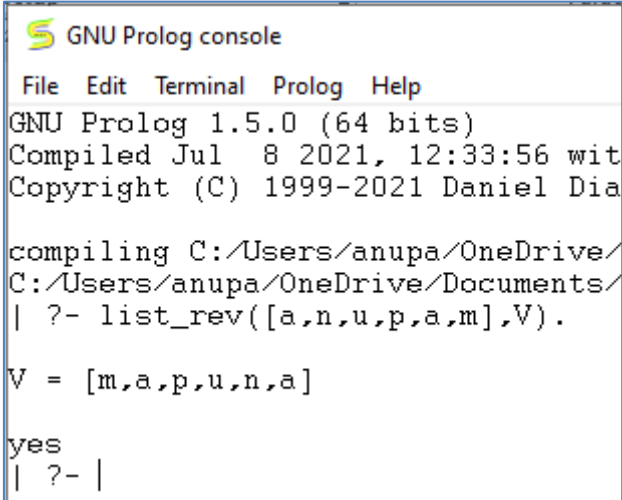
list_concat([X1|L1],L2,[X1|L3]) :-

list_concat(L1,L2,L3).

list_rev([],[]).
list_rev([Head|Tail],Reversed) :-
list_rev(Tail, RevTail),list_concat(RevTail, [Head],Reversed).

10. Write a program in PROLOG to check whether a number or string is a palindrome or not.

Answer-

```
palind([]):- write('palindrome').
palind([_]):- write('palindrome').
palind(L) :-
 append([H|T], [H], L),
 palind(T)
 ;
 write('Not a palindrome').
```

11. Write a program in PROLOG to delete an element from a list.

Ans-

```
remover( _, [], []).
remover( R, [R|T], [T2]) :- remover( R, T, T2).
remover( R, [H|T], [H|T2]) :- H \= R, remover( R, T, T2).
```

12. Write a program in PROLOG for linear search/ binary search in a list.

Ans-

contains(List, Value):- even_division(_, [Value|_], List). contains(List, Value):-

even_division(_, [Center|SecondHalf], List),

      Center<Value, SecondHalf \= [],

      contains(SecondHalf, Value).

contains(List, Value):- even_division(FirstHalf, [Center|_], List),
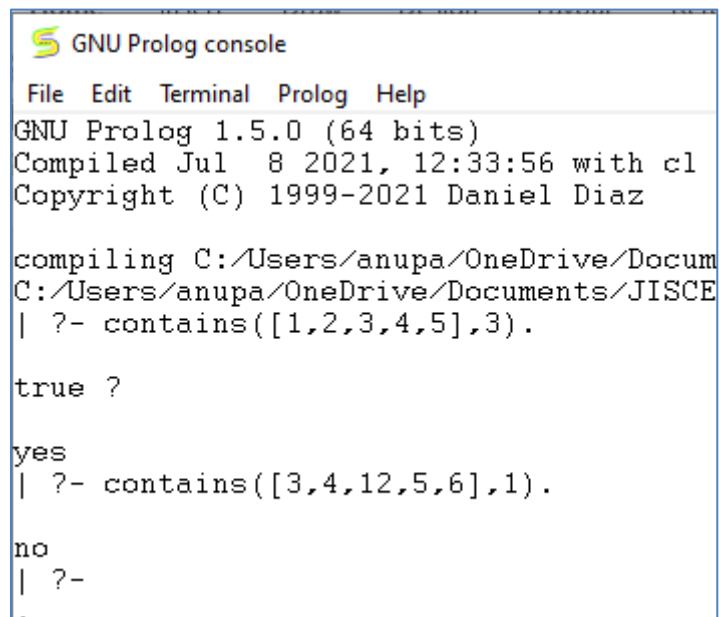
      Center>Value, FirstHalf\=[],

      contains(FirstHalf, Value).

even_division(First, Second, Xs) :- append(First, Second, Xs),

      length(First,F), length(Second,S),S>=F,

      S-F=<1.

13. Write a program in PROLOG to sort n numbers using the bubble sort algorithm.

Ans-

```
bubblesort([], []).
bubblesort([H], [H]).
bubblesort([H|D],
    R) :-
    bubblesort(D,
    E), [B|G] = E,
    (  (H =< B, R = [H|E])
    ;  (H > B,  bubblesort([B,H|G], R))
    ).
```
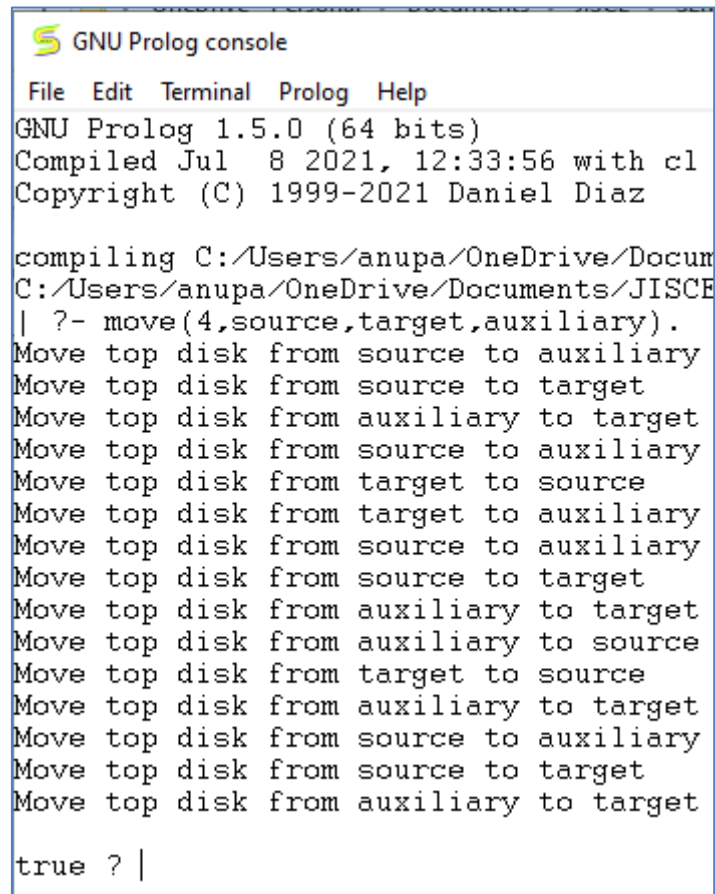
14. Write a program in PROLOG for Towers of Hanoi problem.

Ans-

```
move(1,X,Y,_) :-
write('Move top disk from '), write(X), write(' to '), write(Y), nl. move(N,X,Y,Z) :-
N>1,
M is N-1, move(M,X,Z,Y),
move(1,X,Y,_),
move(M,Z,Y,X).
```

15. Write a program in PROLOG for 4-Queens problem.

Ans-

solution(Queens) :-
permutation([1,2,3,4,5,6,7,8], Queens),safe(Queens).
% safe(Queens): Queens is a list of Y-coordinates of non-attacking queens
safe([]).
safe([Queen|Others]) :-
safe(Others),
noattack(Queen,Others,1).
% noattack(Queen, Queens, Dist):
% Queen does not attack any queen in Queens at horizontal distance Dist
noattack(_,[],_).
noattack(Y,[Y1|Ylist],Xdist) :-
Y1 - Y =\= Xdist, % Not upward diagonal attack
Y - Y1 =\= Xdist, % Not downward diagonal attack
Dist1 is Xdist + 1,
noattack(Y,Ylist,Dist1).
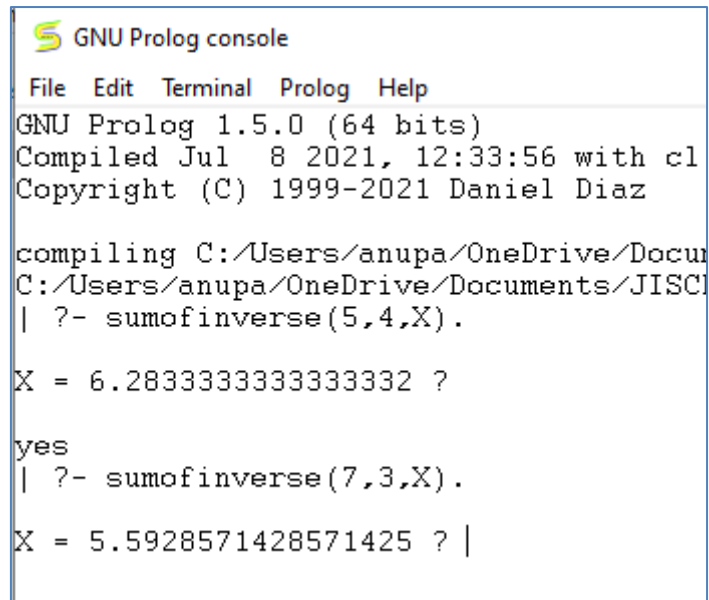
16. Write a Prolog Program to find the sum of inverse of N numbers.

Ans-

```
sumofinverse(N,R) :- sumofinverse(N,0,R).
sumofinverse(0,R,R).
sumofinverse(N,T,R) :- N > 0 , T1 is T+(1/N), N1 is N-1, sumofinverse(N1,T1,R).
```
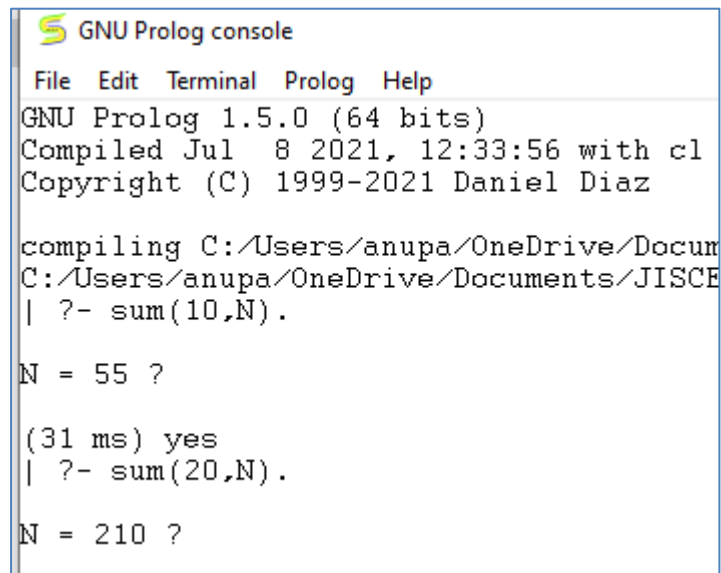
17. Write a Prolog Program to find sum of first N natural numbers.

Ans-

```
sum(0,0).
sum(N,R) :- N > 0 ,
N1 is N-1 , sum(N1,R1) , R is R1+N.
```
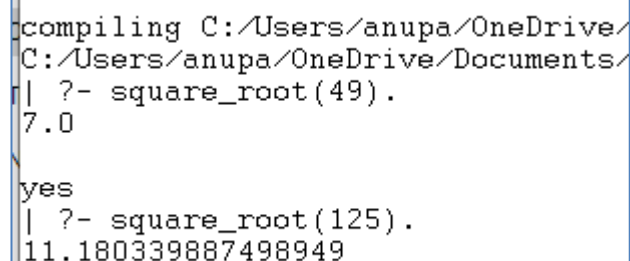

18. Write a Prolog Program to find the square root of a number using function.

Ans-

```
squareroot(X):-A is sqrt(X),write(A).
```

19. Write a Prolog Program to find the modulus of two numbers using function.

Ans-

modulo(A,B):-X is A mod B , write(X).

```
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C:/Users/anupa/OneDrive/Documents/J
| ?- modulo(75,25).
0

yes
| ?- modulo(25,35).
25

yes
| ?- modulo(35,10).
5
```

20 Write a Prolog Program to find the positive negative or zero.
Ans-

```
check(X,Res) :- X>0, !, Res='Positive';X<0,
!, Res='Negative';
Res='Zero'.
```

```
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C:/Users/anupa/OneDrive/Documents/JISCE
| ?- check(15,Res).

Res = 'Positive'

(15 ms) yes
| ?- check(-15,Res).

Res = 'Negative'

yes
```

21. Write a Prolog Program to find even odd using function.

Ans-
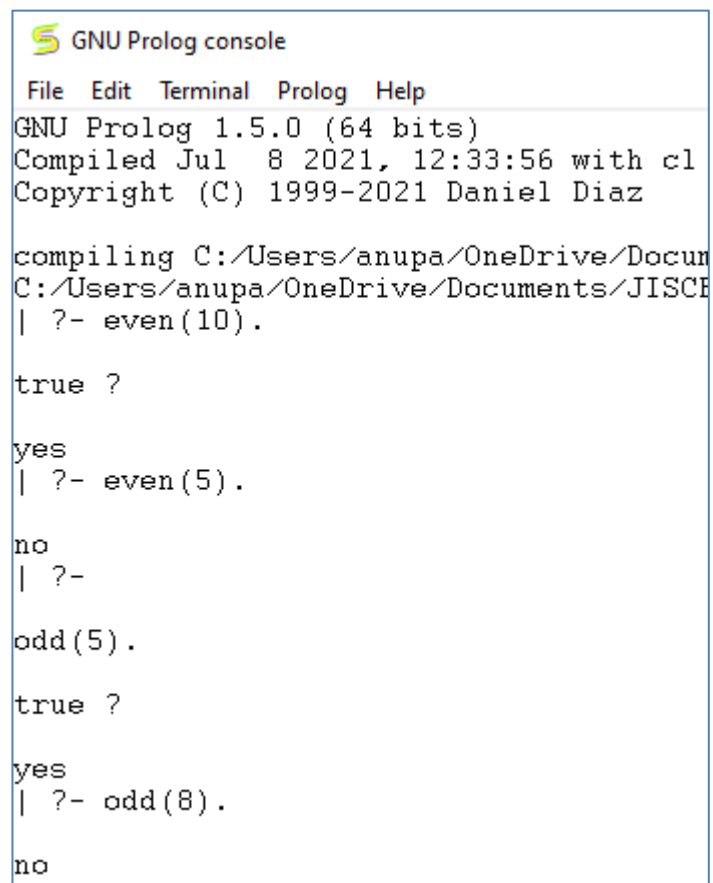
```
even(0).
even(X) :- X > 0, X1 is X - 1, odd(X1).
even(X) :- X < 0, X1 is X + 1, odd(X1).
odd(1).
odd(X) :- X > 0, X1 is X - 1, even(X1).
odd(X) :- X < 0, X1 is X + 1, even(X1).
```

```
GNU Prolog console

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C:/Users/anupa/OneDrive/Documents/JISCE
| ?- even(10).

true ?

yes
| ?- even(5).

no
| ?-

odd(5).

true ?

yes
| ?- odd(8).

no
```
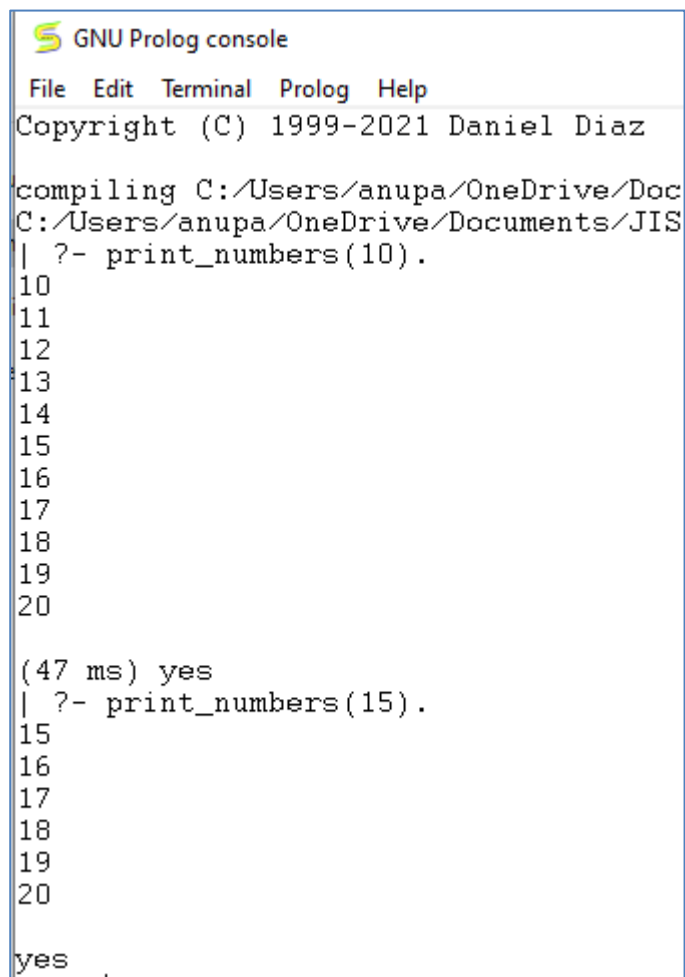
22. Write a Prolog Program to print N to 20 using for loop (Fixing the endvalue).

Ans-

```
print_numbers(20) :- write(20), !.
print_numbers(X) :- write(X), nl, Next is X + 1, print_numbers(Next).
```
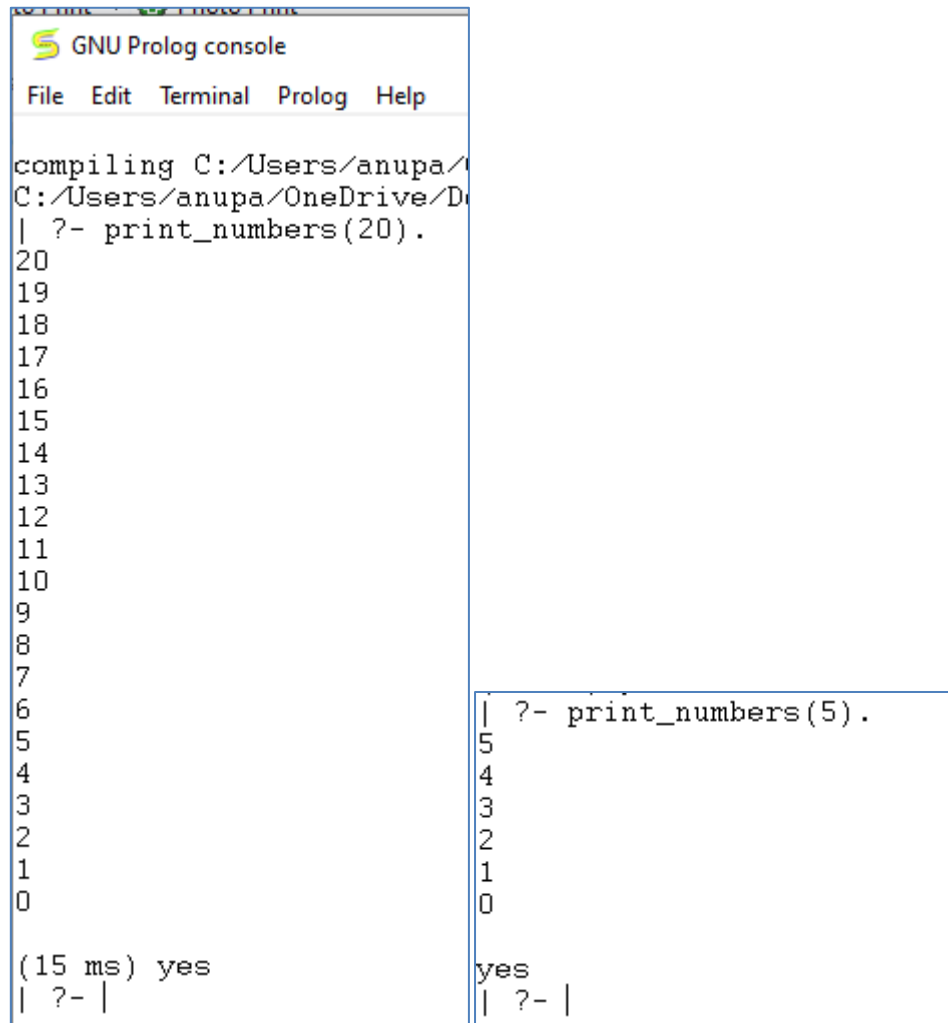
23. Write a Prolog Program to print N to 20 numbers using for loop, in reverse order.

Ans-

```
print_numbers(0) :- write(0), !.
print_numbers(X) :- write(X), nl, Next is X - 1, print_numbers(Next).
```

24 Write a Prolog Program to print N to M numbers using for loop.

Ans-

printloop(F, L) :- F =\= L, write(F), nl, N is F+1, printloop(N,L).
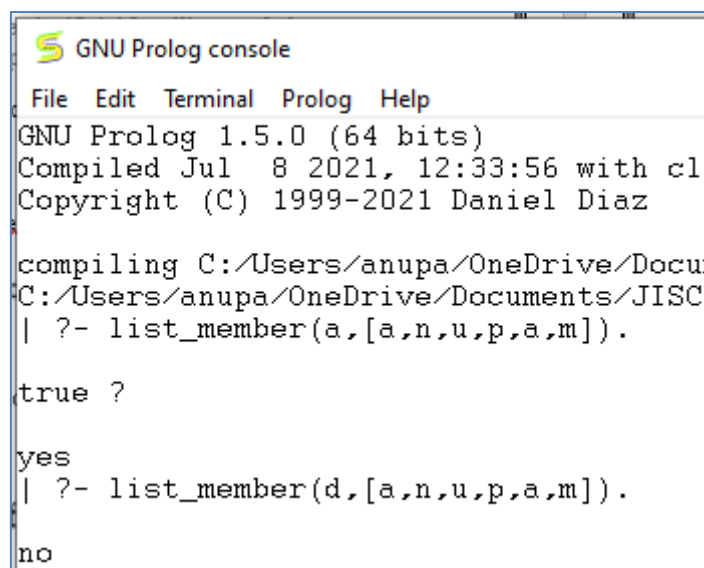
25. Write a Prolog Program to find whether the number is present in list or not.

Ans-

```
list_member(X,[X|_]).
list_member(X,[_|TAIL]) :- list_member(X,TAIL).
```

26. Write a Prolog Program to find the length of the list.

   Ans-

   list_length([],0).
   list_length([_|TAIL],N) :- list_length(TAIL,N1), N is N1 + 1.

```
 GNU Prolog console

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C:/Users/anupa/OneDrive/Documents/JISCE
| ?- list_length([a,n,u,p,a,m],Len).

Len = 6

yes
| ?- list_length([d,u,t,t,a],Len).

Len = 5

yes
| ?- |
```
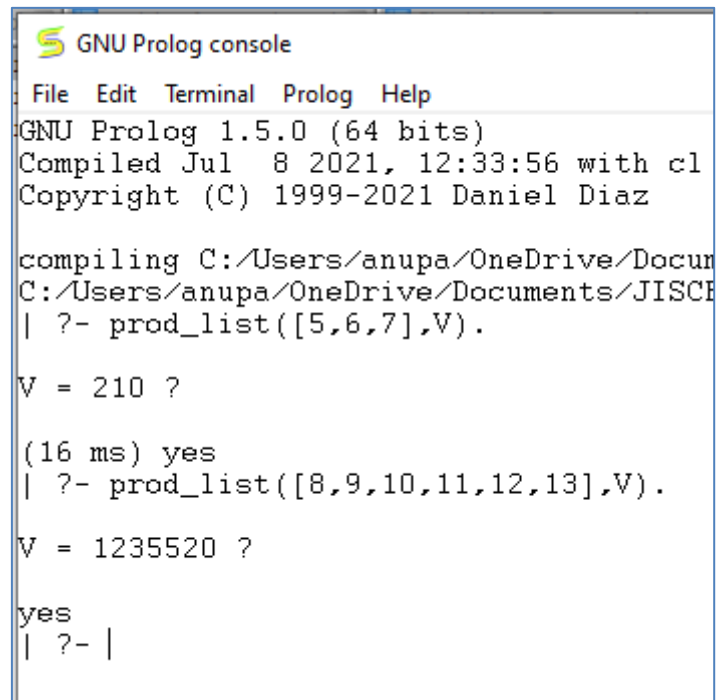
27. Write a Prolog Program to find multiplication of all list members.

Ans-

```
prod_list([],0).
prod_list([H],H).
prod_list([H|T], Product) :- prod_list(T, Rest), Product is H * Rest.
```

28. Write a Prolog Program to append a new list to another list.

Ans-

```
append([ ], Y, Y).
append([X|L1],L2,[X|L3]):-append(L1,L2,L3).
```
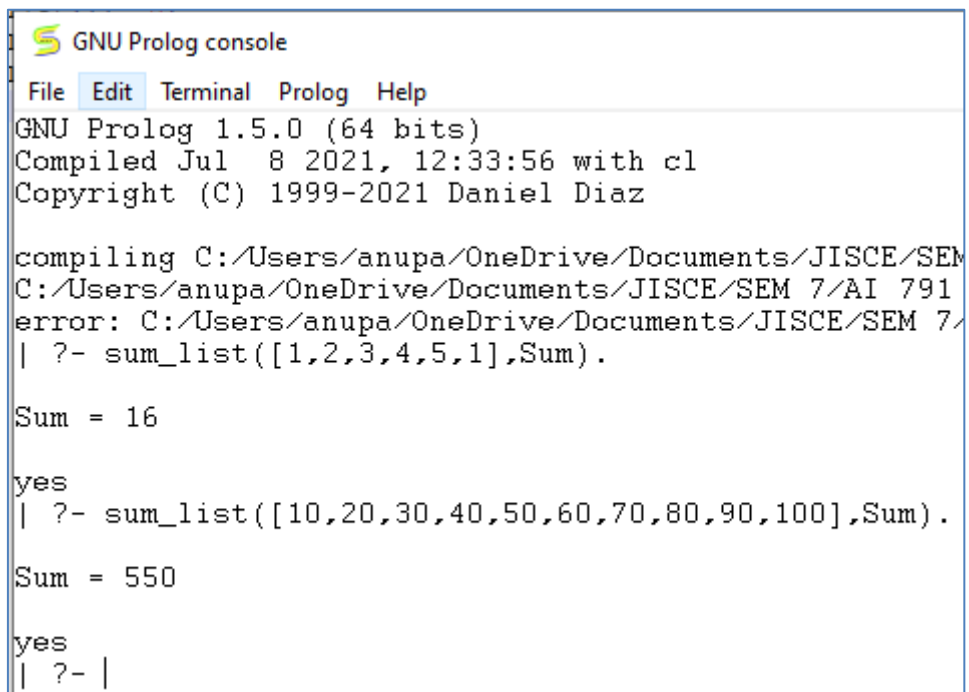
29. Write a Prolog Program to find sum of all list members.

   Ans-

   sum_list([], 0).

   sum_list([H|T], Sum) :-

   sum_list(T, Rest), Sum is H + Rest.

```
GNU Prolog console

File  Edit  Terminal  Prolog  Help
GNU Prolog 1.5.0 (64 bits)
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C:/Users/anupa/OneDrive/Documents/JISCE/SEM 7/AI 791
error: C:/Users/anupa/OneDrive/Documents/JISCE/SEM 7/
| ?- sum_list([1,2,3,4,5,1],Sum).

Sum = 16

yes
| ?- sum_list([10,20,30,40,50,60,70,80,90,100],Sum).

Sum = 550

yes
| ?- |
```