AI Practical File

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sem : 6th

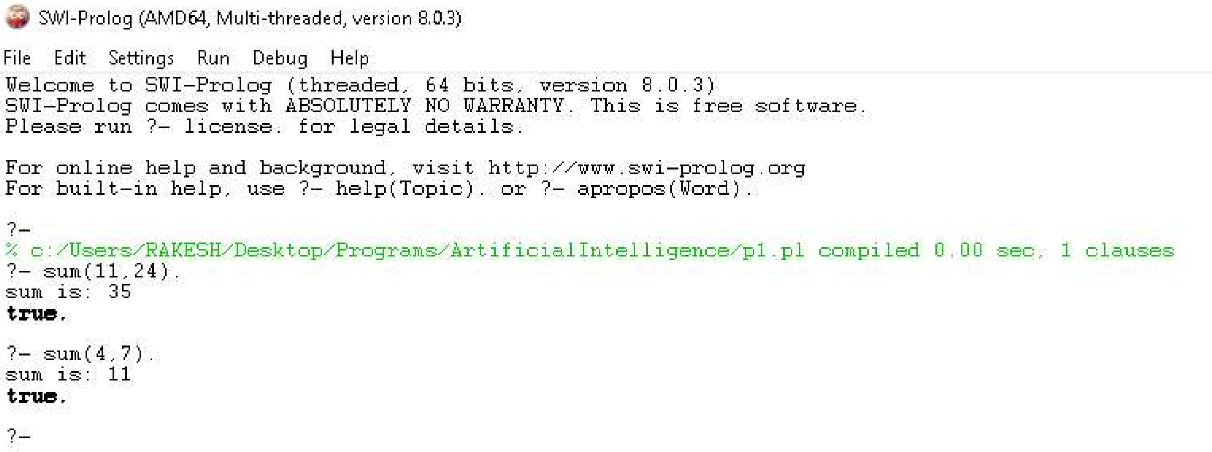
Sec: B

B.sc(H) Computer Science

P 1. Write a prolog program to calculate the sum of two numbers.

Ans:

```
sum(X,Y):-Z is X + Y,write("sum is: "),write(Z).
```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?-
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p1.pl compiled 0.00 sec, 1 clauses
?- sum(11,24).
sum is: 35
true.

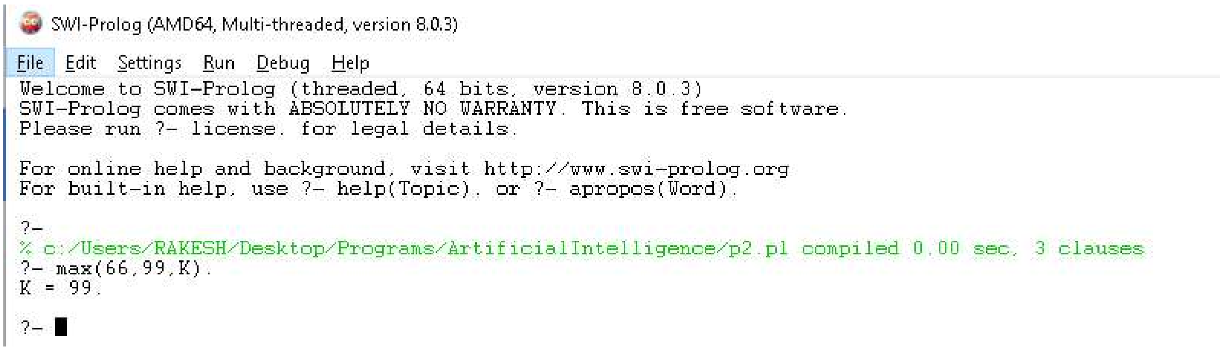
?- sum(4,7).
sum is: 11
true.

?-
```

P 2. Write a Prolog program to implement max(X, Y, M) so that M is the maximum of two numbers X and Y.

Ans:

```
max(X,Y,M):-
    (X>Y,
      M is X).
max(X,Y,M):-
    (Y>X,
      M is Y ).
max(X,Y):-
    (X>Y
    -> print(X);
   print(Y)
    ).
```



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?-
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p2.pl compiled 0.00 sec, 3 clauses
?- max(66,99,K).
K = 99.

?-
```
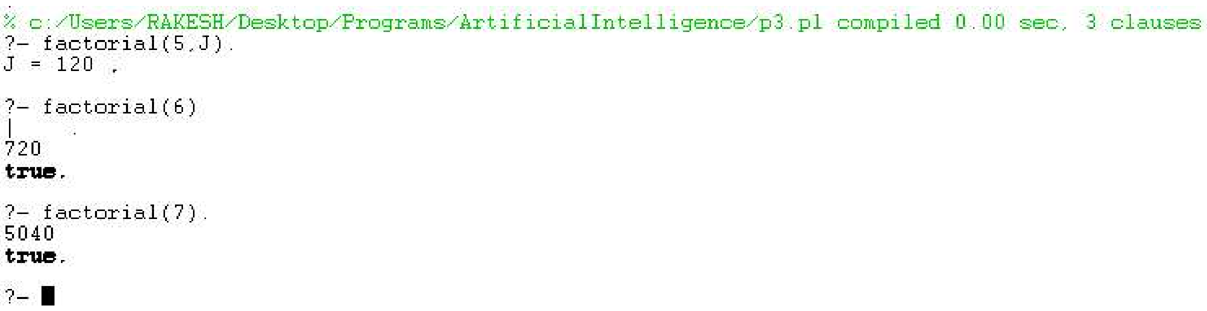

P 3. Write a program in PROLOG to implement factorial (N, F) where F represents the factorial of a number N.

Ans:

```
factorial(N):- factorial(N, A), print(A),!.
        factorial(0,1).
        factorial(N,F):-(
           N > 0
           -> (
                 N1 is N-1,
                 factorial(N1, F1),
                 F is N*F1
              )
           ; print("Not defined"),!
        ).
```

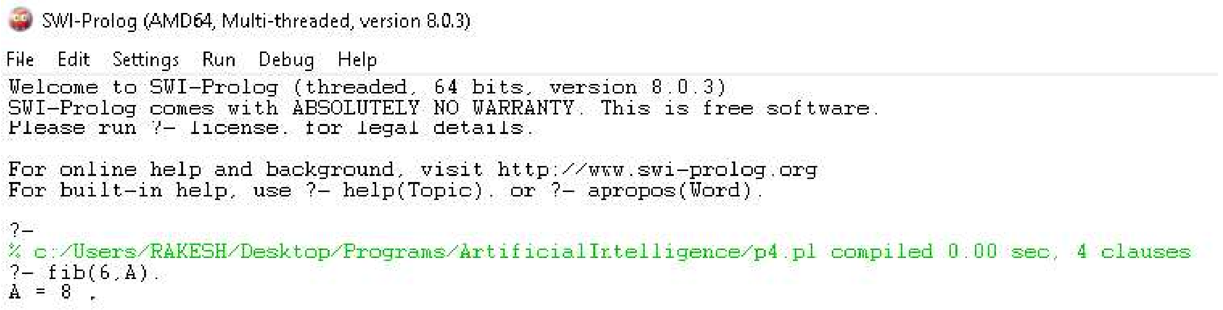


```
.
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p3.pl compiled 0.00 sec, 3 clauses
?- factorial(5,J).
J = 120 .

?- factorial(6)
|     .
720
true.

?- factorial(7).
5040
true.

?-
```

P 4. Write a program in PROLOG to implement generate_fib(N,T) where T represents the Nth term of the fibonacci series.

Ans:

```
fib(X):-fib(X, A), print(A),!.
fib(1,1).
fib(2,1).
fib(X,T):-
(
    X > 0
    ->(
        X1 is X-1,
        X2 is X-2,
        fib(X1, T1),
        fib(X2, T2),
        T is T1 + T2
        )
    ; print("Not Defined"),!
).
```



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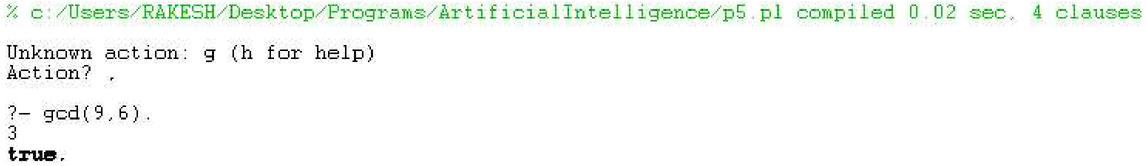
?-
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p4.pl compiled 0.00 sec, 4 clauses
?- fib(6,A).
A = 8 .
```

P 5. Write a Prolog program to implement GCD of two numbers.

Ans:

```
gcd(A,B):-A1 is abs(A), B1 is abs(B), gcd(A1, B1, N1), print(N1).
gcd(0,B,N):- N is B.
gcd(A,0,N):- N is A.
gcd(A,B,N):-
   (   A = B
       ->  N is A
       ;   (   A > B
               ->  (   N1 is A-B,
                       gcd(N1,B, G),
                       N is G
                   )
               ;   (   N1 is B - A,
                       gcd(A, N1, G),
                    N is G
                )
            )
  ).
```



```
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p5.pl compiled 0.02 sec, 4 clauses

Unknown action: g (h for help)
Action? .

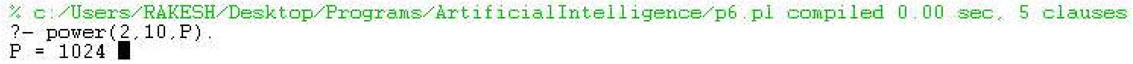
?- gcd(9,6).
3
true.
```

P 6. Write a Prolog program to implement power (Num,Pow, Ans) : where Num is raised to the power Pow to get Ans.

Ans:

```
power(N, P):- power(N, P, A), print(A),!.
power(1, _, 1).
power(0, _, 0).
power(_, 0, 1).
power(N, P, A):-
(
   P > 0
   -> (
         P1 is P - 1,
         power(N, P1, A1),
         A is N*A1
      )
   ;  (
         P1 is P + 1,
         power(N, P1, A1),
         A is 1/N*A1
      )

).
```



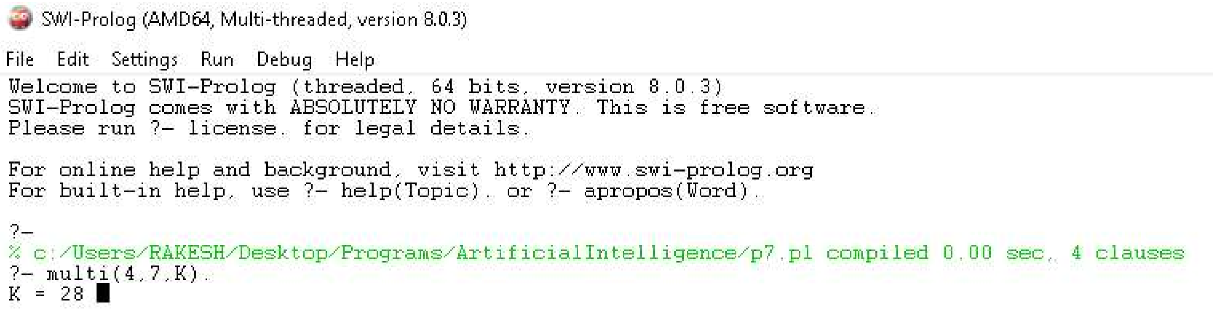
```
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p6.pl compiled 0.00 sec, 5 clauses
?- power(2,10,P).
P = 1024 █
```

P 7. Prolog program to implement multi (N1, N2, R) : where N1 and N2 denotes the numbers to be multiplied and R represents the result.

Ans:

```
multi(N1,N2):-multi(N1,N2,R), print(R).
multi(0, _, 0).
multi(_, 0, 0).
multi(N1,N2,R):-
(   N2 > 0
    ->  (
            N2_1 is N2 - 1,
            multi(N1,N2_1,R_1),
            R is N1 + R_1
        )
    ;   (
            N2_1 is N2 + 1,
            multi(N1,N2_1,R_1),
            R is -1*N1 + R_1
        )

).
```



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?-
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p7.pl compiled 0.00 sec, 4 clauses
?- multi(4,7,K).
K = 28
```
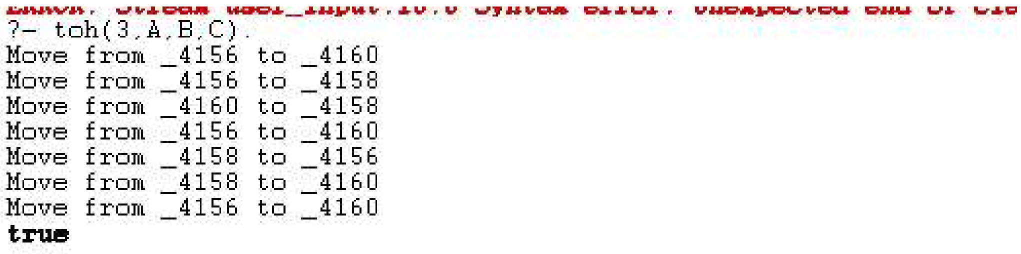

P 8. Write a program in PROLOG to implement towerofhanoi (N) where N represents the number of discs

Ans:

```
toh(N):-
(
   N < 0
   -> print("Not defined")
   ;  power(2, N, R),
      R1 is R - 1,
      write("No of steps: "),write(R1),nl,
      toh(N, "a","b","c")
).
toh(1, A,_,C):-write("Move from "),write(A),write(" to "),write(C),nl.
toh(N, A, B, C):-
(
   N1 is N-1,
   toh(N1, A,C,B),
   write("Move from "),write(A),write(" to "),write(C),nl,
   toh(N1, B,A,C)
).
```

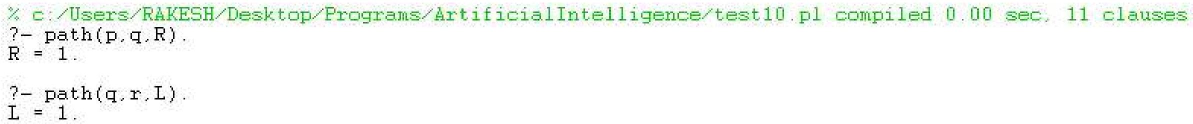


```
ERROR: Stream user_input:10:0 Syntax error: Unexpected end of file
?- toh(3,A,B,C).
Move from _4156 to _4160
Move from _4156 to _4158
Move from _4160 to _4158
Move from _4156 to _4160
Move from _4158 to _4156
Move from _4158 to _4160
Move from _4156 to _4160
true
```

P 9.Consider a cyclic directed graph [edge (p, q), edge (q, r), edge (q, r), edge (q, s), edge (s,t)] where edge (A,B) is a predicate indicating directed edge in a graph from a node A to a node B. Write a program to check whether there is a route from one node to another node.

Ans:

```
node(p).
node(q).
node(r).
node(s).
node(t).
edge(p,q).
edge(q,r).
edge(r,q).
edge(q,s).
edge(s,t).
path(X,Y,R):-
(
    node(X),
    node(Y),
    X \= Y
    ->  (
            edge(X,Y)
            ->  R is 1
            ;   (
                    edge(X,Z),
                    Y \= Z,
                    path(Z,Y, R2),
                    R2 = 1
                    ->  R is 1
                    ;   R is 0
                )
        )
    ; R is 0
).
```

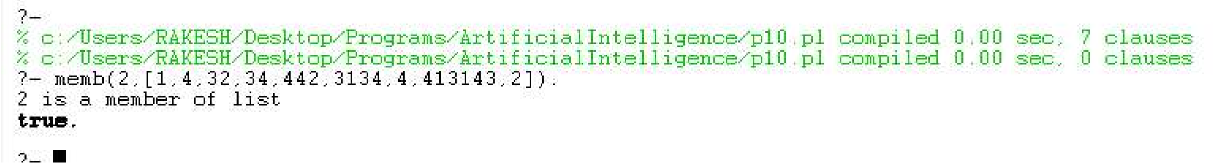


```
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/test10.pl compiled 0.00 sec, 11 clauses
?- path(p,q,R).
R = 1.

?- path(q,r,L).
L = 1.
```

P 10. Write a Prolog program to implement memb(X, L): to check whether X is a member of L or not.

Ans:

```
memb(M,L):-(
    memb(M,L,R),
    R = 1
    ->  write(M), write(" is a member of list"),!
    ;   write(M), write(" is not a member of list"),!
).
memb(H, [H|_], 1).
memb(X, [H|T], R):-
(
   X = H
   ->R is 1
   ;  (
         memb(X, T, R1),
         R is R1
      )
).


len(L):-len(L,R),write("Length of list is: "),write(R).
len([], 0).
len([_|T], R):-
(
   len(T, R1),
   R is R1 + 1
).

append(X, L):-conc([X],L,R), print(R).
```



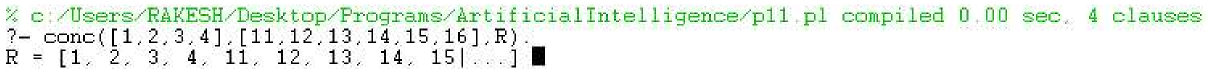
```
?-
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p10.pl compiled 0.00 sec, 7 clauses
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p10.pl compiled 0.00 sec, 0 clauses
?- memb(2,[1,4,32,34,442,3134,4,413143,2]).
2 is a member of list
true.

?- ■
```

P 11.Write a Prolog program to implement conc (L1, L2, L3) where L2 is the list to be appended with L1 to get the resulted list L3.

Ans:

```
conc(X1,X2):-conc(X1,X2,R),write("concatenated list is:
"),write(R),!.
conc([], X, X).
conc(X, [], X).
conc([H1|T1], L2, [H1|T3]):- conc(T1, L2, T3).
```

O/P

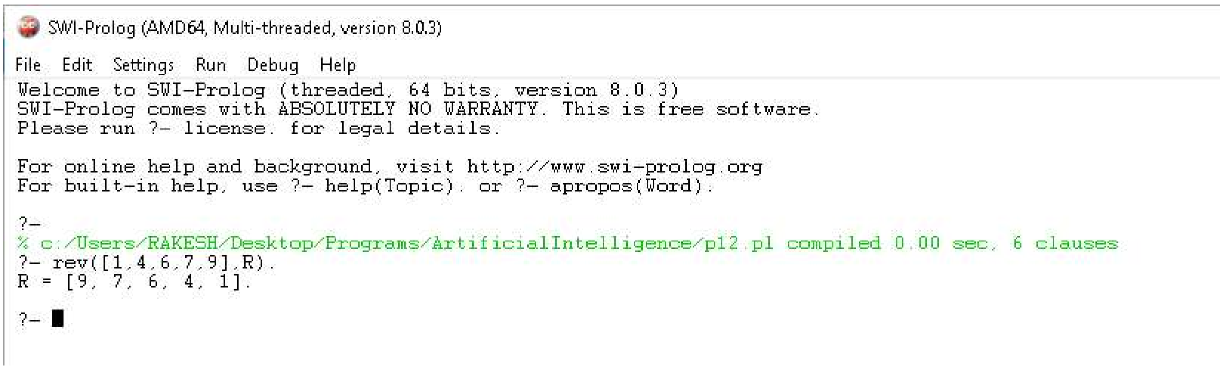


```
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p11.pl compiled 0.00 sec, 4 clauses
?- conc([1,2,3,4],[11,12,13,14,15,16],R).
R = [1, 2, 3, 4, 11, 12, 13, 14, 15|...] 
```

P 12.Write a Prolog program to implement reverse (L, R) where List L is original and List R is reversed list.

Ans:

```
rev(X):-rev(X,R),write("reversed list is: "),write(R).
rev(X, R):-rev(X,[],R).
rev([], X, X).
rev([H1|T1], PREV, REV):-rev(T1, [H1|PREV], REV).
/*equals*/
equals([], []):-print("yes").
equals([H1|T1],[H2|T2]):-
(
   H1 = H2
   -> equals(T1, T2)
   ; print("no")
).
```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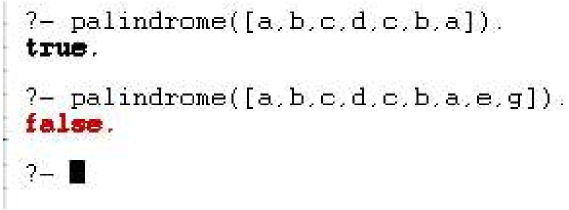
?-
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p12.pl compiled 0.00 sec, 6 clauses
?- rev([1,4,6,7,9],R).
R = [9, 7, 6, 4, 1].

?- 
```

P 13.Write a program in PROLOG to implement palindrome (L) which checks whether a list L is a palindrome or not.

Ans:

```
palindrome(X):-rev(X,Y), X = Y.
```



```
?- palindrome([a,b,c,d,c,b,a]).
true.

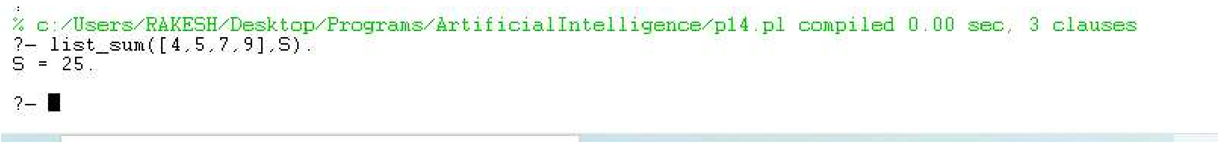
?- palindrome([a,b,c,d,c,b,a,e,g]).
false.

?- 
```

P 14.Write a Prolog program to implement sumlist(L, S) so that S is the sum of a given list L.

Ans:

```
list_sum(L1):-list_sum(L1,S),write("sum of list is: "),write(S).
list_sum([], 0).
list_sum([H|T], R):-
(
   list_sum(T, R1),
   R is H + R1
).
```



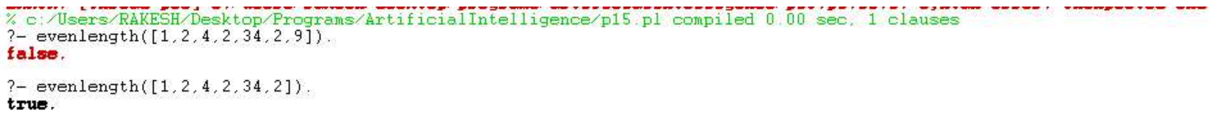
```
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p14.pl compiled 0.00 sec, 3 clauses
?- list_sum([4,5,7,9],S).
S = 25.

?- 
```

P 15.Write a Prolog program to implement two predicates evenlength(List) and oddlength(List) so that they are true if their argument is a list of even or odd length respectively

Ans:

```
evenlength(L1):-
(
   len(L1, R1),
   0 is mod(R1,2)
).
oddlength(L2):-
(
   len(L2, R1),
   1 is mod(R1,2),
   print("true")
)
```



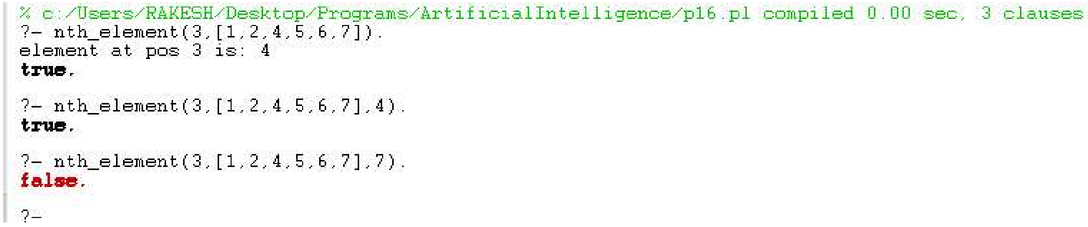
```
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p15.pl compiled 0.00 sec, 1 clauses
?- evenlength([1,2,4,2,34,2,9]).
false.

?- evenlength([1,2,4,2,34,2]).
true.
```

P 16.Write a Prolog program to implement nth_element (N, L, X) where N is the desired position, L is a list and X represents the Nth element of L.

Ans:

```
nth_element(N, L):-nth_element(N, L, X),write("element at pos "),write(N),write(" is: "),write(X),!.
nth_element(_, [], _):-print("out of bounds"),!.
nth_element(N, [H|T], X):-
(
    N > 0
    ->  (
            N = 1
            ->X is H
            ;   (
                    N1 is N - 1,
                    nth_element(N1, T, X)
                )
        )
    ; print("Invalid index")
).
```



```
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p16.pl compiled 0.00 sec, 3 clauses
?- nth_element(3,[1,2,4,5,6,7]).
element at pos 3 is: 4
true.

?- nth_element(3,[1,2,4,5,6,7],4).
true.

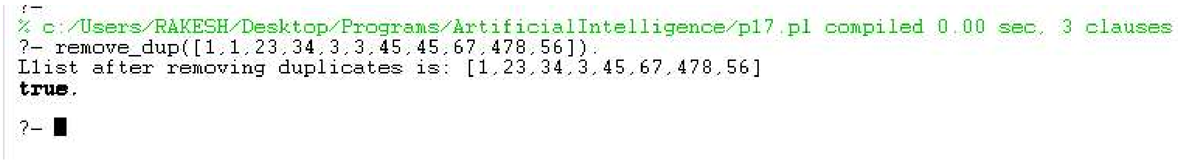
?- nth_element(3,[1,2,4,5,6,7],7).
false.

?-
```

P 17.Write a program in PROLOG to implement remove_dup (L, R) where L denotes the list with some duplicates and the list R denotes the list with duplicates removed.

Ans:

```
remove_dup(L):-remove_dup(L, R),write("List after removing duplicates is: "),write(R),!.
remove_dup([], []).
remove_dup([H|T], [H|R]):-
(
   delete_all(H, T, R1),
   remove_dup(R1, R)
).
```



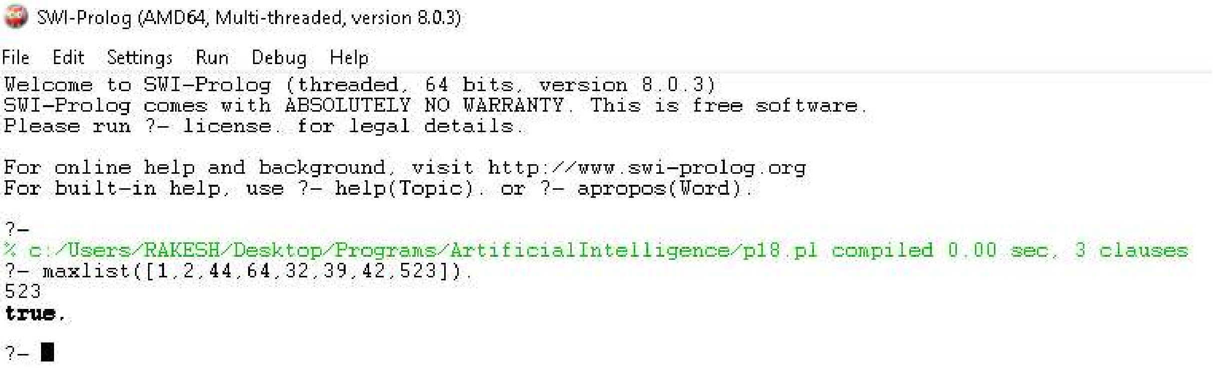
```
?-
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p17.pl compiled 0.00 sec, 3 clauses
?- remove_dup([1,1,23,34,3,3,45,45,67,478,56]).
Llist after removing duplicates is: [1,23,34,3,45,67,478,56]
true.

?- 
```

P 18.Write a Prolog program to implement maxlist(L, M) so that M is the maximum number in the list

Ans:

```
maxlist([H|T]):-maxlist(T, H).
maxlist([H|[]], M):-
(
   M > H
   -> print(M),!
   ; print(H),!
).
maxlist([H|T], M):-
(
   M > H
   ->maxlist(T, M)
   ; maxlist(T, H)
).
```



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?-
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p18.pl compiled 0.00 sec, 3 clauses
?- maxlist([1,2,44,64,32,39,42,523]).
523
true.

?- 
```
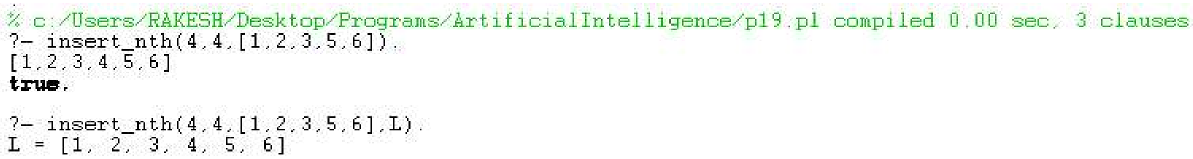

P 19.Write a prolog program to implement insert_nth(I, N, L, R) that inserts an item I into Nth position of list L to generate a list R.

Ans:

```
insert_nth(X, P, L):-insert_nth(X, P, L, R),print(R),!.
insert_nth(X, 1, Y, [X|Y]).
insert_nth(X, P, [H|T], [H|T1]):-
(
   P1 is P - 1,
   insert_nth(X, P1, T, T1)
).
```

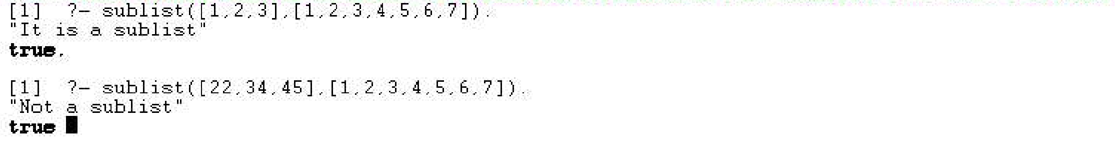


```
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p19.pl compiled 0.00 sec, 3 clauses
?- insert_nth(4,4,[1,2,3,5,6]).
[1,2,3,4,5,6]
true.

?- insert_nth(4,4,[1,2,3,5,6],L).
L = [1, 2, 3, 4, 5, 6]
```

P 20.Write a Program in PROLOG to implement sublist(S, L) that checks whether the list S is the sublist of list L or not. (Check for sequence or the part in the same order).

Ans:

```
sublist([],[]):-print("It is a sublist").
sublist([], [_|_]):-print("It is a sublist").
sublist([_|_], []):-print("Not a sublist").
sublist([H|T], [H1|T1]):-
(
   H = H1
   -> sublist(T, T1)
   ;  sublist([H|T], T1)
).
```

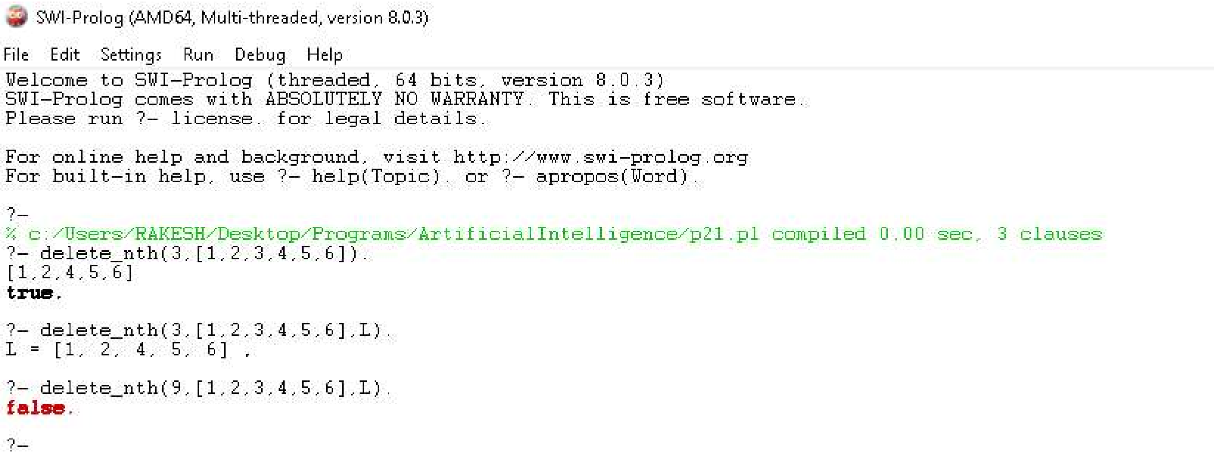


```
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p20.pl compiled 0.00 sec, 0 clauses
[1]  ?- sublist([1,2,3],[1,2,3,4,5,6,7]).
"It is a sublist"
true.

[1]  ?- sublist([22,34,45],[1,2,3,4,5,6,7]).
"Not a sublist"
true █
```

P 21.Write a Prolog program to implement delete_nth (N, L, R) that removes the element on Nth position from a list L to generate a list R.

Ans:

```
delete_nth(P, L):-delete_nth(P, L,R), print(R),!.
delete_nth(1, [_|T], T).
delete_nth(P, [H|T], [H|T1]):-
(
   P1 is P - 1,
   delete_nth(P1, T, T1)
).
```



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?-
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p21.pl compiled 0.00 sec, 3 clauses
?- delete_nth(3,[1,2,3,4,5,6]).
[1,2,4,5,6]
true.

?- delete_nth(3,[1,2,3,4,5,6],L).
L = [1, 2, 4, 5, 6] .

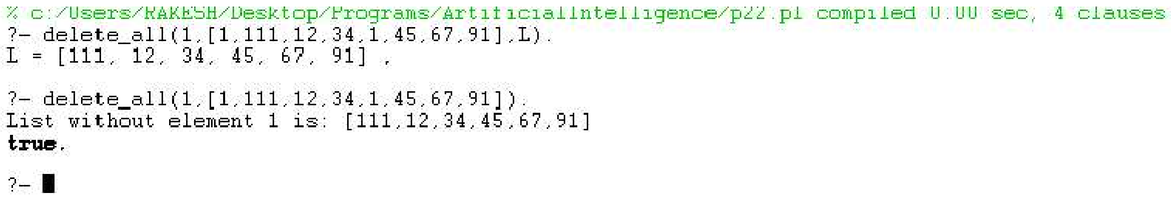
?- delete_nth(9,[1,2,3,4,5,6],L).
false.

?-
```

P 22.Write a program in PROLOG to implement delete_all (X, L, R) where X denotes the element whose all occurrences has to be deleted from list L to obtain list R.

Ans:

```
delete_all(X, L):-delete_all(X,L,R),write("List without element "),
write(X),write(" is: "),write(R),!.
delete_all(_, [], []).
delete_all(X, [X|T], L):-delete_all(X, T, L).
delete_all(X, [H|T], [H|T1]):-delete_all(X, T, T1).
```



```
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p22.pl compiled 0.00 sec, 4 clauses
?- delete_all(1,[1,111,12,34,1,45,67,91],L).
L = [111, 12, 34, 45, 67, 91] .

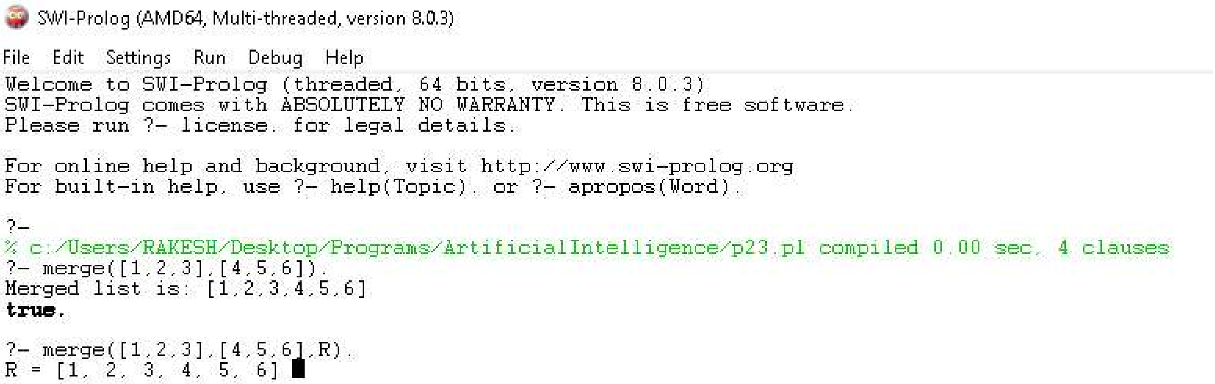
?- delete_all(1,[1,111,12,34,1,45,67,91]).
List without element 1 is: [111,12,34,45,67,91]
true.

?- 
```

P 23.Write a program in PROLOG to implement merge (L1, L2, L3) where L1 is first ordered list and L2 is second ordered list and L3 represents the merged list.

Ans:

```
merge(X, Y):-merge(X, Y, R), write("Merged list is: "),write(R),!.
merge([], X, X).
merge(X, [], X).
merge([H1|T1], [H2|T2], [X|R]):-
(
   H1 < H2
   ->  X is H1,
       merge(T1, [H2|T2], R)
   ;   X is H2,
       merge([H1|T1], T2, R)
).
```



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?-
% c:/Users/RAKESH/Desktop/Programs/ArtificialIntelligence/p23.pl compiled 0.00 sec, 4 clauses
?- merge([1,2,3],[4,5,6]).
Merged list is: [1,2,3,4,5,6]
true.

?- merge([1,2,3],[4,5,6],R).
R = [1, 2, 3, 4, 5, 6]
```