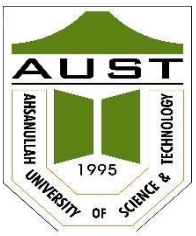
AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
DHAKA-1208, BANGLADESH.



Department of Computer Science and Engineering
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Course No: CSE 4108

Course Title: Artificial Intelligence Lab

Assignment No: 02

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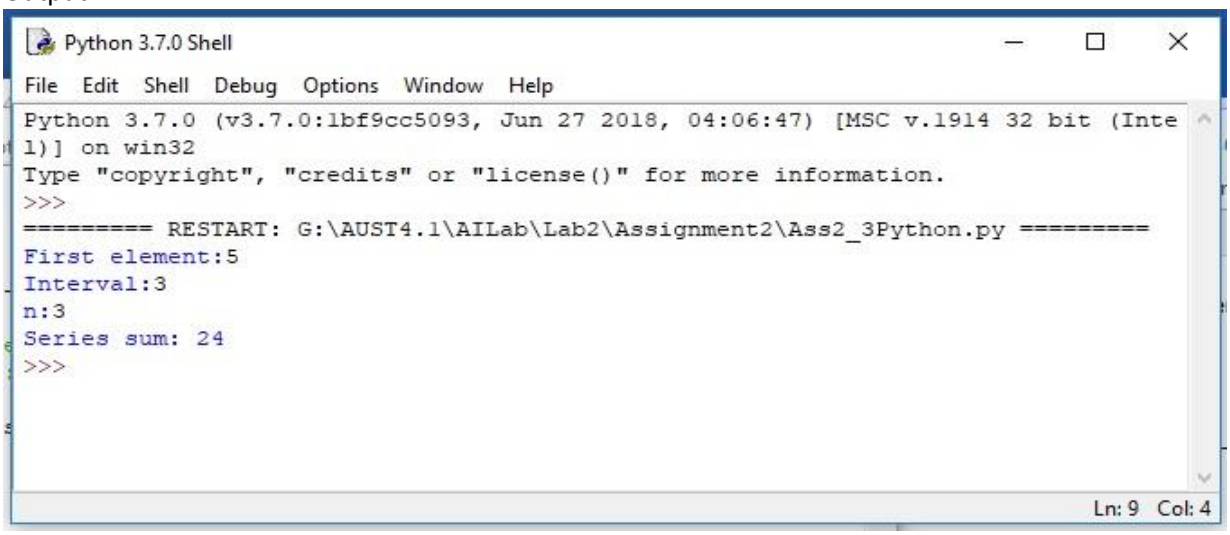
1) **Define a recursive procedure in Python and in Prolog to find the sum of 1st n terms of an equal-interval series given the 1st term and the interval.**

Solution:

Python

```
def ssum(N,I,F):
    if (N==0):
        return 0
    elif (N>=1):
        return ssum(N-1,I,F)+F+(N-1)*I
# Main
f=int(input('First element:'))
d=int(input('Interval:'))
n=int(input('n:'))
print('Series sum:', ssum(n,d,f))
```

Output

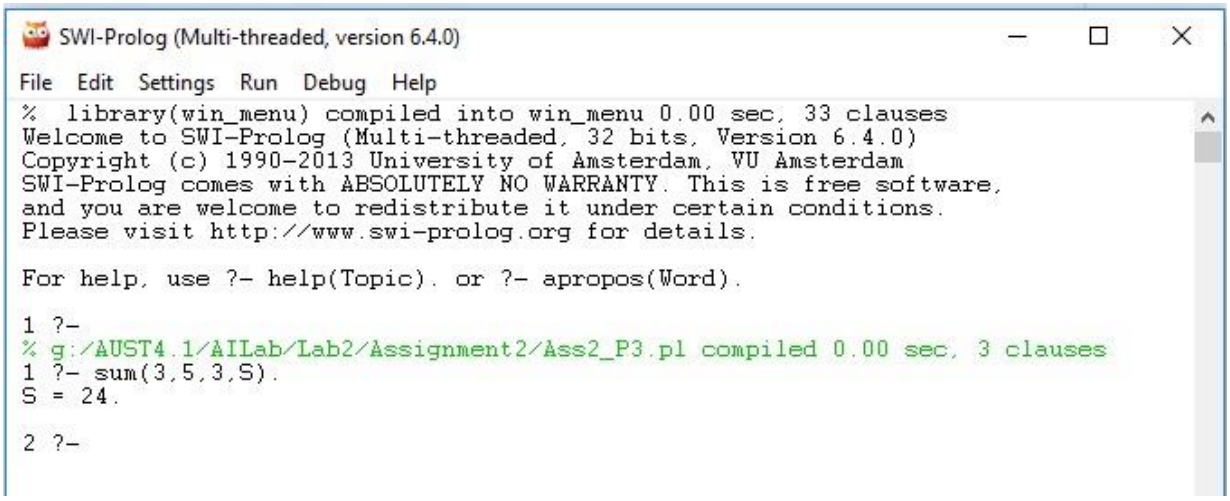


Prolog

```
sum(1,_,S,S):-!.

sum(N,I,T,S) :-
    N > 1 ,
        T1 is T+I ,
        N1 is N-1 ,
         sum(N1,I,T1,S1),
         S is S1+T.
```

Output



2) Define a recursive procedure in Python and in Prolog to find the length of a path between two vertices of a directed weighted graph.

Solution:

Python

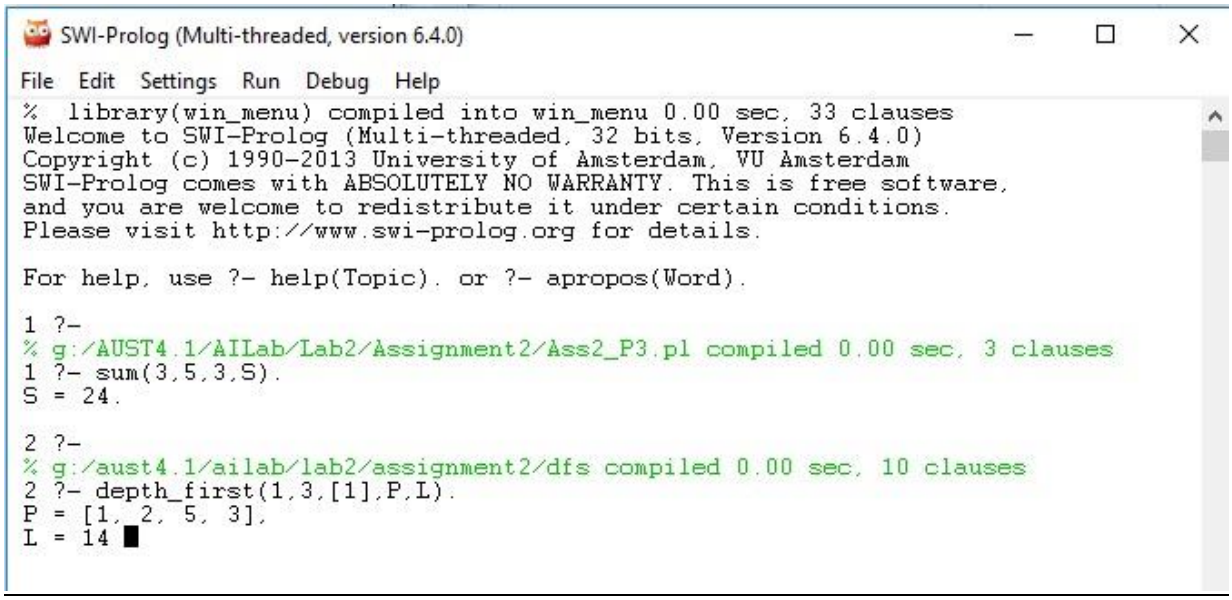
```
edge(1,2,10).
edge(1,4,11).
edge(2,5,3).
edge(5,4,8).
edge(5,3,1).

connected(X,Y,D) :- edge(X,Y,D).

next_node(Current, Next, Path) :-
    connected(Current, Next, _),
    not(member(Next, Path)).

depth_first(Goal, Goal, _, [Goal],0).
depth_first(Start, Goal, Visited, [Start|Path],L) :-
    next_node(Start, Next_node, Visited),
    edge(Start,Next_node,D),
    depth_first(Next_node, Goal, [Next_node|Visited], Path,L1),
    L is L1+D.
```

Output:

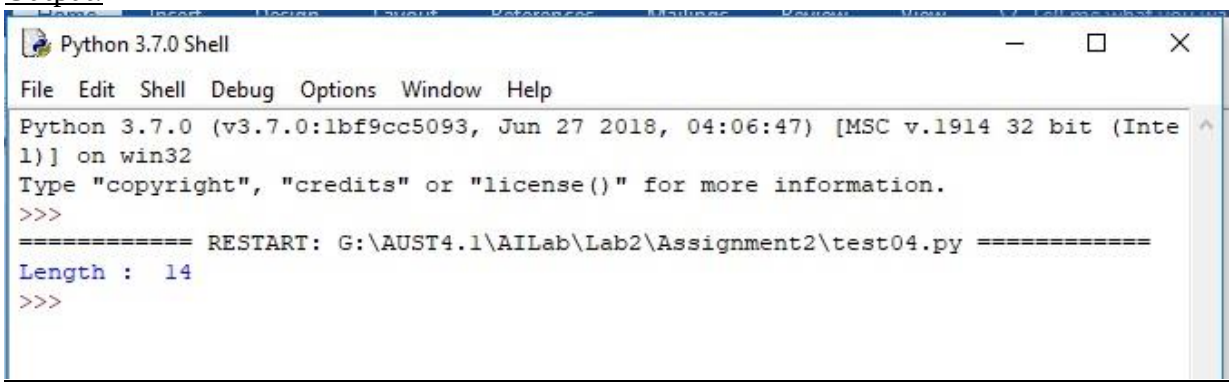


Python:

```
from array import *
v = array('i', [0,0,0,0,0])
Graph=[(1,2,10),
       (1,4,11),
       (2,5,3),
       (4,5,8),
       (5,3,1)]
def dfs(S,G,v):
    if(S==G):
        return 0
    else :
        for i in range(5):
            if((Graph[i][0]==S)&(v[Graph[i][1]]==0)):
                v.insert(Graph[i][1],1)
                return Graph[i][2]+dfs(Graph[i][1],G,v)


#Main
print('Length : ',dfs(1,3,v))
```

Output:



3) Modify the Python and Prolog codes demonstrated above to find h_2 and h_3 discussed above.

Solution:

Heuristic function (H2):

```
go:- calcH(1,[],L),
     sumList(L,V),
     write('Heuristics: '), write(V).

calcH(9,X,X):-!.
calcH(T,X,Y):- dist(T,D),
       append(X,[D],X1),
       T1 is T+1,
       calcH(T1,X1,Y).

dist(T,V):-tp(T,A,B),
   gtp(T,C,D),
   V is abs(A-C) + abs(B-D).

sumList([],0):-!.
sumList(L,V):-L=[H|T],
       sumList(T,V1), V is V1+H.
```

Heuristic function (H3):

```
:-dynamic(hval/1).

/* Evaluates a 8-queens' state given as list of 8 digits */

evalState(L,V):- assert(hval(0)),hl(1,L), di_up(1,L),di_dn(1,L),hval(V),
                retractall(hval(_)).

hl(8,_):-!.
```

```
hl(I,L):- nthel(I,L,X), chk_incr(I,L,X), I1 is I+1, hl(I1,L).

chk_incr(8,_,_):-!.
chk_incr(I,L,X):- I1 is I+1, nthel(I1,L,Y),
                do_incr(X,Y),chk_incr(I1,L,X).
do_incr(X,Y):- X=Y, incr_hval.  do_incr(_,_).

incr_hval:-hval(V), V1 is V+1, retract(hval(_)), assert(hval(V1)).

di_up(8,_):-!.
di_up(I,L):- nthel(I,L,X), chkup_incr(I,L,X,0), I1 is I+1,
                        di_up(I1,L).
chkup_incr(8,_,_,_):-!.
chkup_incr(I,L,X,K):- I1 is I+1, nthel(I1,L,Y), K1 is K+1,
                                doup_incr(X,Y,K1), chkup_incr(I1,L,X,K1).

doup_incr(X,Y,K1):- X1 is X+K1, Y=X1, incr_hval.  doup_incr(_,_,_).

di_dn(8,_):-!.
di_dn(I,L):- nthel(I,L,X), chkdn_incr(I,L,X,0), I1 is I+1,
                        di_dn(I1,L).

chkdn_incr(8,_,_,_):-!.
chkdn_incr(I,L,X,K):- I1 is I+1, nthel(I1,L,Y), K1 is K+1,
dodn_incr(X,Y,K1), chkdn_incr(I1,L,X,K1).

dodn_incr(X,Y,K1):- X1 is X-K1, Y=X1, incr_hval.  dodn_incr(_,_,_).


% A procedure to find the nth element of a list

nthel(N,[_|T],El):- N1 is N-1, nthel(N1,T,El).
nthel(1,[H|_],H):-!.
```