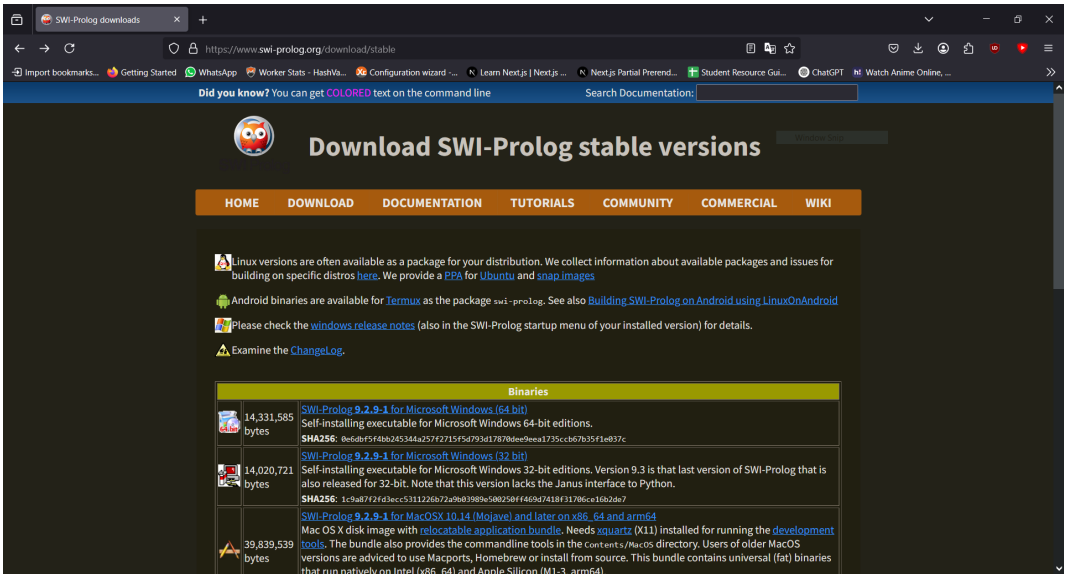
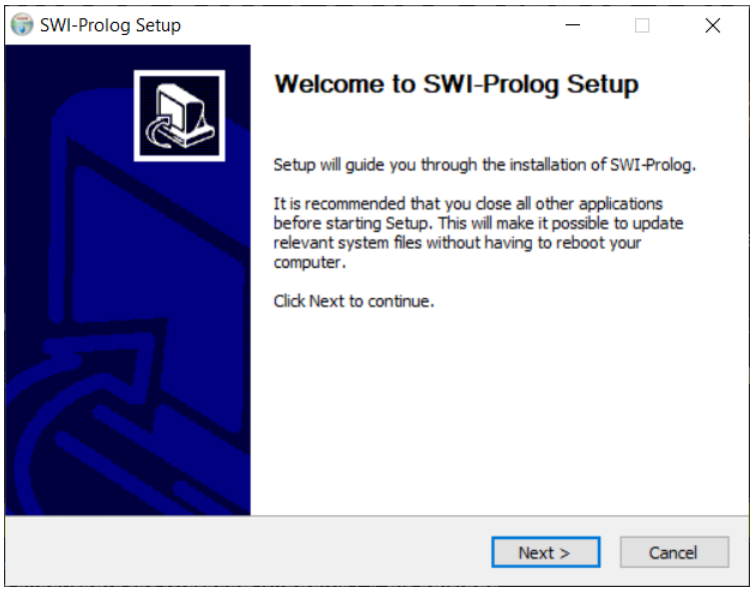
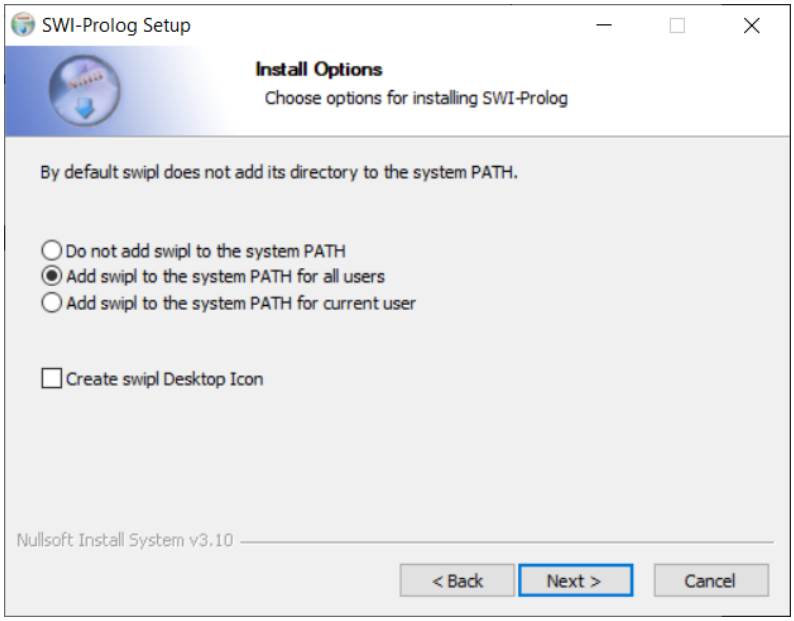
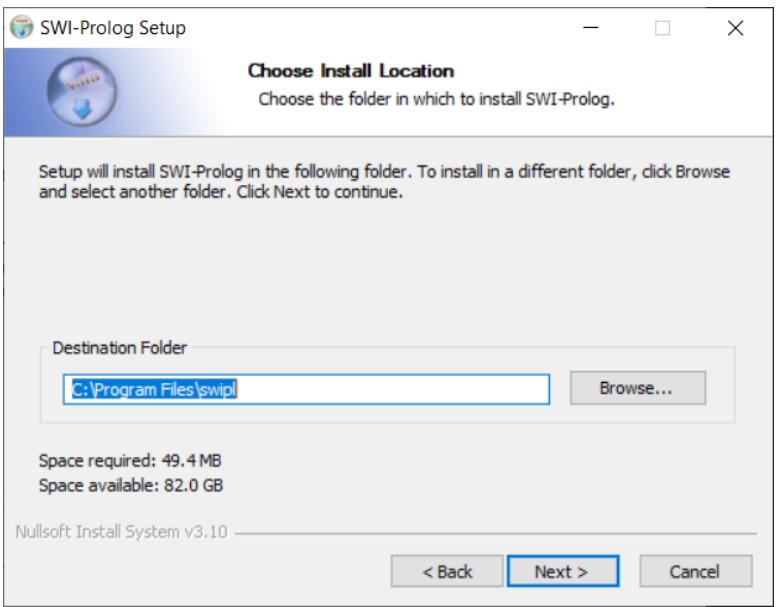
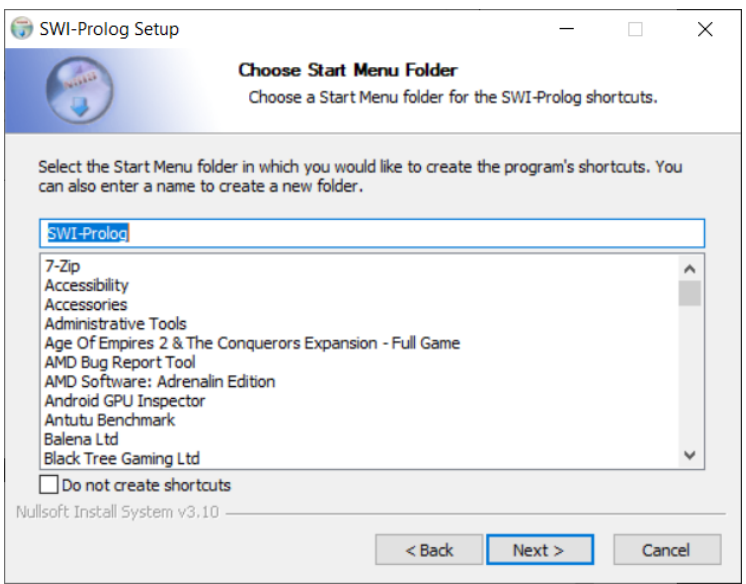
Experiment-1

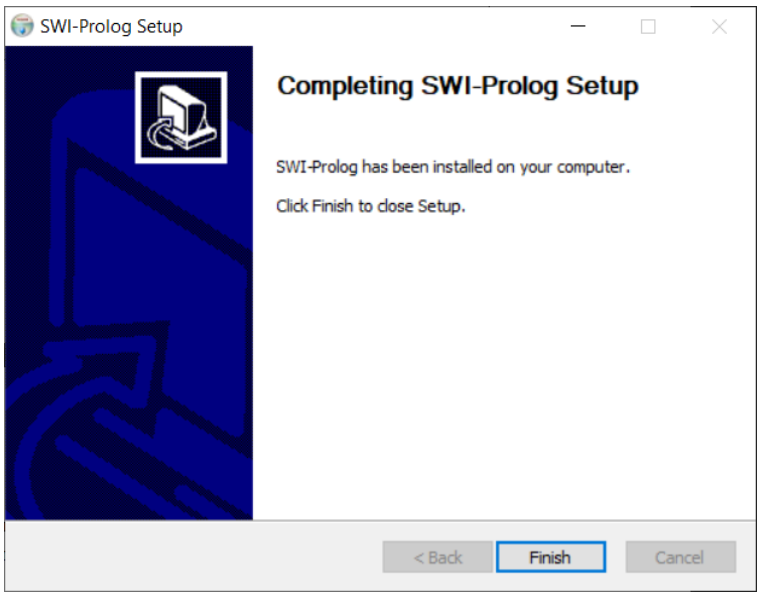











SWI-Prolog Setup
Completing SWI-Prolog Setup
SWI-Prolog has been installed on your computer.
Click Finish to close Setup.
< Back
Finish
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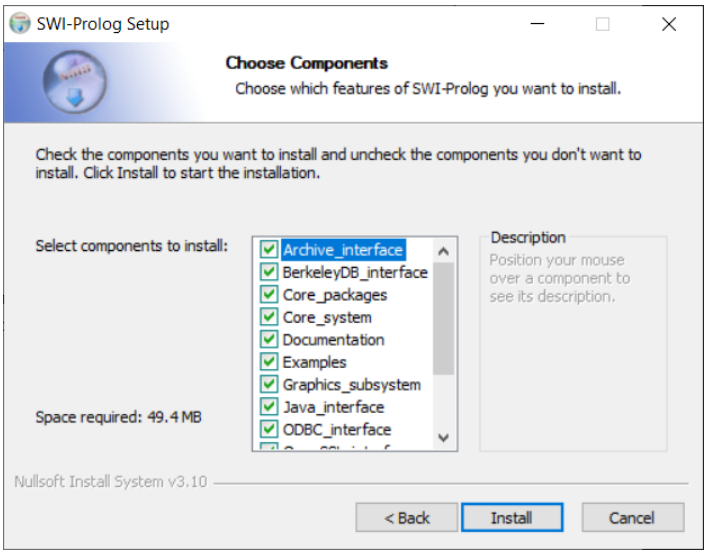
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Choose Components
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Select components to install:
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Core_packages
Core_system
Documentation
Examples
Graphics_subsystem
Java_interface
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Description
Position your mouse over a component to see its description.
Space required: 49.4 MB
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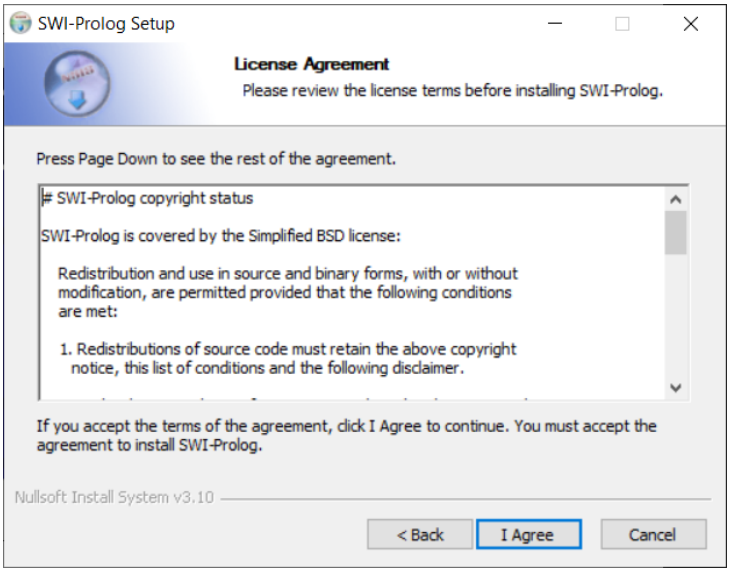
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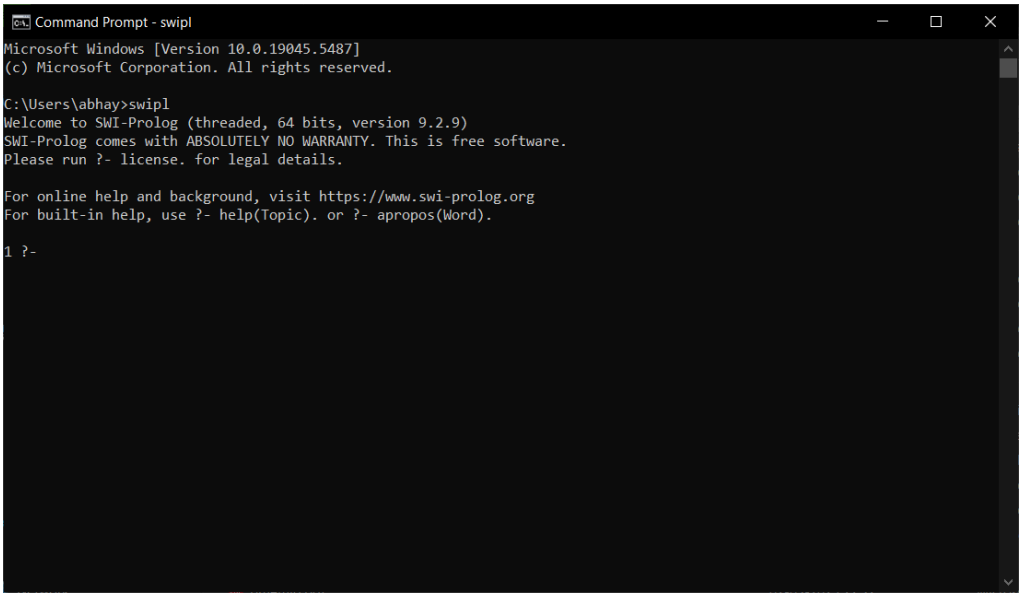
Command Prompt - swipl
Microsoft Windows [Version 10.0.19045.5487]
(c) Microsoft Corporation. All rights reserved.
C:\Users\abhay>swipl
Welcome to SWI-Prolog (threaded, 64 bits, version 9.2.9)
SWI-Prolog comes with ABSOLUTELY NO WARRANTY. This is free software.
Please run ?- license. for legal details.
For online help and background, visit https://www.swi-prolog.org
For built-in help, use ?- help(Topic). or ?- apropos(Word).
1 ?-

Experiment – 2

Code:-

```
square(Number, Result) :-
  Result is Number * Number.
area_circle(Radius, Area) :-
  Area is 3.14159 * Radius * Radius.
area_square(Side, Area) :-
  Area is Side * Side.
area_rectangle(Length, Width, Area) :-
  Area is Length * Width.
simple_interest(Principal, Rate, Time, Interest) :-
  Interest is (Principal * Rate * Time) / 100.
```

```
?- sqaure(4,16).
Correct to: "square(4,16)"? yes
true.

?- area_circle(1,1)
|    .
false.

?- area_rectangle(1,1,1).
true.

?- simple_interest(1, 1, 1, 1).
false.
```

Experiment – 3

Code:-

```
even(Number) :-
  Number mod 2 =:= 0.
odd(Number) :-
  Number mod 2 =\= 0.
max(X, Y, X) :-
  X >= Y.
max(X, Y, Y) :-
  Y > X.
grade(Marks, 'A Grade') :-
  Marks >= 90.
grade(Marks, 'B Grade') :-
  Marks >= 75,
  Marks < 90.
grade(Marks, 'C Grade') :-
  Marks >= 50,
  Marks < 75.
grade(Marks, 'Fail') :-
  Marks < 50.
```

```
?- even(5).
false.

?- odd(3).
true.

?- grade(55,'A Grade').
false.
```

Output:-

Experiment – 4

Code:-

```
% Facts
likes(ram, mango).
girl(seema).
likes(bill, cindy).
color(rose, red).
owns(john, gold).
```

Output:-

```
?- likes(ram, mango).
true.

?- girl(seema).
true.

?- likes(bill, cindy).
true.

?- color(rose, red).
true.

?- owns(john, gold).
true.

?-
```

Experiment – 5

```
c_to_f(C, F) :-
  F is (C * 9 / 5) + 32.
below_freezing(C) :-
  C < 0.
```

```
?- c_to_f(0,32).
true.

?- below_freezing(9).
false.

?-
```

Output:-

Experiment – 6

```
edge(a, b).
edge(b, c).
edge(c, d).
edge(d, a).
edge(b, e).

show_edges :-
  write('Edges of the graph:'), nl,
  edge(X, Y),
  write(X), write(' -> '), write(Y), nl,
  fail.
show_edges.

show_neighbors(Node) :-
  write('Neighbors of '), write(Node), write(':'), nl,
  edge(Node, Neighbor),
  write(Neighbor), nl,
  fail.
show_neighbors(_).

show_graph :-
  show_edges, nl,
  show_neighbors(a),
  show_neighbors(b),
  show_neighbors(c),
  show_neighbors(d).

dfs(Node, Visited) :-
  write('Visiting node: '), write(Node), nl,
  edge(Node, Neighbor),
  not(member(Neighbor, Visited)),
  dfs(Neighbor, [Node | Visited]).
dfs(_, _).

start_dfs(Node) :-
  write('Start DFS from node: '), write(Node), nl,
  dfs(Node, []).
```

```
?- start_dfs(a)
Start DFS from node: a
Visiting node: a
Visiting node: b
Visiting node: c
Visiting node: d
true
```

Experiment – 7

Output:-

```
?- move(0,0,[(0,0)]).
fill 4 jug
fill 3 jug
pour 4 jug
pour 3 jug
fill 4 jug
pour from 4jug to 3jug
pour 3 jug
pour from 4jug to 3jug
fill 4 jug
pour from 4jug to 3jug
pour 3 jug
done
true
```

Code:-

```
member(X,[X|_]).
member(X,[Y|Z]):-member(X,Z).

move(X,Y,_):-X=:=2,Y=:=0,write('done'),!.
move(X,Y,Z):-X<4,\+member((4,Y),Z),write("fill 4 jug"),nl,move(4,Y,[(4,Y)|Z]).
move(X,Y,Z):-Y<3,\+member((X,3),Z),write("fill 3 jug"),nl,move(X,3,[(X,3)|z]).
move(X,Y,Z):-X>0,\+member((0,Y),Z),write("pour 4 jug"),nl,move(0,Y,[(0,Y)|Z]).
move(X,Y,Z):-Y>0,\+member((X,0),Z),write("pour 3 jug"),nl,move(X,0,[(X,0)|Z]).
move(X,Y,Z):-P is X+Y,P>=4,Y>0,K is 4-X,M is Y-K,\+member((4,M),Z),write("pour from 3jug to
4jug"),nl,move(4,M,[(4,M)|Z]).
move(X,Y,Z):-P is X+Y,P>=3,X>0,K is 3-Y,M is X-K,\+member((M,3),Z),write("pour from 4jug to
3jug"),nl,move(M,3,[(M,3)|Z]).
move(X,Y,Z):-K is X+Y,K<4,Y>0,\+member((K,0),Z),write("pour from 3jug to 4jug"),nl,move(K,0,[(K,0)|Z]).
move(X,Y,Z):-K is X+Y,K<3,X>0,\+member((0,K),Z),write("pour from 4jug to 3jug"),nl,move(0,K,[(0,K)|Z]).
```

Experiment – 8 Code:-

```
test(Plan):-
  write('Initial state:'),nl,
  Init= [at(tile4,1), at(tile3,2), at(tile8,3),
at(empty,4), at(tile2,5), at(tile6,6), at(tile5,7), at(tile1,8), at(tile7,9)],
  write_sol(Init),
  Goal= [at(tile1,1), at(tile2,2), at(tile3,3),
at(tile4,4), at(empty,5), at(tile5,6), at(tile6,7), at(tile7,8), at(tile8,9)],
  nl,write('Goal state:'),nl,
  write(Goal),nl,nl,
  solve(Init,Goal,Plan).

solve(State, Goal, Plan):-
  solve(State, Goal, [], Plan).

is_movable(X1,Y1) :- (1 is X1 - Y1) ; (-1 is X1 - Y1) ; (3 is X1 - Y1) ; (-3 is X1 - Y1).

solve(State, Goal, Plan, Plan):-
  is_subset(Goal, State), nl,
  write_sol(Plan).

solve(State, Goal, Sofar, Plan):-
  act(Action, Preconditions, Delete, Add),
  is_subset(Preconditions, State),
  \+ member(Action, Sofar),
  delete_list(Delete, State, Remainder),
  append(Add, Remainder, NewState),
  solve(NewState, Goal, [Action|Sofar], Plan).

act(move(X,Y,Z),
  [at(X,Y), at(empty,Z), is_movable(Y,Z)],
  [at(X,Y), at(empty,Z)],
  [at(X,Z), at(empty,Y)]).
is_subset([H|T], Set):-
  member(H, Set),
  is_subset(T, Set).
is_subset([], _).
delete_list([H|T], Curstate, Newstate):-
  remove(H, Curstate, Remainder),
  delete_list(T, Remainder, Newstate).
delete_list([], Curstate, Curstate).
remove(X, [X|T], T).
remove(X, [H|T], [H|R]):-
  remove(X, T, R).
write_sol([]).
write_sol([H|T]):-
  write_sol(T),
  write(H), nl.
append([H|T], L1, [H|L2]):-
  append(T, L1, L2).
append([], L, L).
member(X, [X|_]).
member(X, [_|T]):-
  member(X, T).
```

Output:-

```
?- test(Plan).
Initial state:
at(tile7,9)
at(tile1,8)
at(tile5,7)
at(tile6,6)
at(tile2,5)
at(empty,4)
at(tile8,3)
at(tile3,2)
at(tile4,1)

Goal state:
[at(tile1,1),at(tile2,2),at(tile3,3),at(tile4,4),at(empty,5),at(tile5,6),at(tile6,7),at(tile7,8),at(tile8,9)]

false.
```

Experiment – 9

Aim:- Write a program to implement a Tic-Tac-Toe game using Prolog.

Code:-

```
win(b, p) :- rowwin(b, p).
win(b, p) :- colwin(b, p).
win(b, p) :- diagwin(b, p).

rowwin(b, p) :- b = [p,p,p,_,_,_,_,_,_].
rowwin(b, p) :- b = [_,_,_,p,p,p,_,_,_].
rowwin(b, p) :- b = [_,_,_,_,_,_,p,p,p].

colwin(b, p) :- b = [p,_,_,p,_,_,p,_,_].
colwin(b, p) :- b = [_,p,_,_,p,_,_,p,_].
colwin(b, p) :- b = [_,_,p,_,_,p,_,_,p].

diagwin(b, p) :- b = [p,_,_,_,p,_,_,_,p].
diagwin(b, p) :- b = [_,_,p,_,p,_,p,_,_].

other(x,o).
other(o,x).

game(b, p) :- win(b, p), !, write([p, p, wins]).
game(b, p) :-
 other(p,Otherp),
 move(b,p,Newb),
 !,
 display(Newb),
 game(Newb,Otherp).

move([b,B,C,D,E,F,G,H,I], p, [p,B,C,D,E,F,G,H,I]).
move([A,b,C,D,E,F,G,H,I], p, [A,p,C,D,E,F,G,H,I]).
move([A,B,b,D,E,F,G,H,I], p, [A,B,p,D,E,F,G,H,I]).
move([A,B,C,b,E,F,G,H,I], p, [A,B,C,p,E,F,G,H,I]).
move([A,B,C,D,b,F,G,H,I], p, [A,B,C,D,p,F,G,H,I]).
move([A,B,C,D,E,b,G,H,I], p, [A,B,C,D,E,p,G,H,I]).
move([A,B,C,D,E,F,b,H,I], p, [A,B,C,D,E,F,p,H,I]).
move([A,B,C,D,E,F,G,b,I], p, [A,B,C,D,E,F,G,p,I]).
move([A,B,C,D,E,F,G,H,b], p, [A,B,C,D,E,F,G,H,p]).

display([A,B,C,D,E,F,G,H,I]) :- write([A,B,C]),nl,write([D,E,F]),nl,
 write([G,H,I]),nl,nl.

selfgame :- game([b,b,b,b,b,b,b,b,b],x).

x_can_win_in_one(b) :- move(b, x, Newb), win(Newb, x).

orespond(b,Newb) :-
 move(b, o, Newb),
 win(Newb, o),
 !.
orespond(b,Newb) :-
 move(b, o, Newb),
 not(x_can_win_in_one(Newb)).
orespond(b,Newb) :-
 move(b, o, Newb).
orespond(b,Newb) :-
 not(member(b,b)),
 !,
 write('Cats game!'), nl,
 Newb = b.

xmove([b,B,C,D,E,F,G,H,I], 1, [x,B,C,D,E,F,G,H,I]).
xmove([A,b,C,D,E,F,G,H,I], 2, [A,x,C,D,E,F,G,H,I]).
xmove([A,B,b,D,E,F,G,H,I], 3, [A,B,x,D,E,F,G,H,I]).
xmove([A,B,C,b,E,F,G,H,I], 4, [A,B,C,x,E,F,G,H,I]).
xmove([A,B,C,D,b,F,G,H,I], 5, [A,B,C,D,x,F,G,H,I]).
xmove([A,B,C,D,E,b,G,H,I], 6, [A,B,C,D,E,x,G,H,I]).
xmove([A,B,C,D,E,F,b,H,I], 7, [A,B,C,D,E,F,x,H,I]).
xmove([A,B,C,D,E,F,G,b,I], 8, [A,B,C,D,E,F,G,x,I]).
xmove([A,B,C,D,E,F,G,H,b], 9, [A,B,C,D,E,F,G,H,x]).
xmove(b, _, b) :- write('Illegal move.'), nl.

playo :- explain, playfrom([b,b,b,b,b,b,b,b,b]).
```

```
explain :-
 write('You play X by entering integer positions followed by a period.'),
 nl,
 display([1,2,3,4,5,6,7,8,9]).

playfrom(b) :- win(b, x), write('You win!').
playfrom(b) :- win(b, o), write('I win!').
playfrom(b) :- read(N),
 xmove(b, N, Newb),
 display(Newb),
 orespond(Newb, Newnewb),
 display(Newnewb),
 playfrom(Newnewb).
```

Output:-

```
?- playo.
You play X by entering integer positions followed by a period.
[1,2,3]
[4,5,6]
[7,8,9]

|: 1.
[x,b,b]
[b,b,b]
[b,b,b]

[x,o,b]
[b,b,b]
[b,b,b]

|: 4.
[x,o,b]
[x,b,b]
[b,b,b]

[x,o,b]
[x,b,b]
[o,b,b]

|: 9.
[x,o,b]
[x,b,b]
[o,b,x]

[x,o,b]
[x,o,b]
[o,b,x]

|: 8.
[x,o,b]
[x,o,b]
[o,x,x]

[x,o,o]
[x,o,b]
[o,x,x]

I win!
true .
```