

The Knights Tour Problem

		X		X			
	X				X		
			K				
	X				X		
		X		X			

?- knightstour(3,5,1,1,K).

No

?- knightstour(3,5,3,3,K).

No

?- knightstour(3,6,1,1,K).

No

?- knightstour(4,4,1,2,K).

No

?- knightstour(4,5,1,1,K).

= [[1, 1], [2, 3], [1, 5], [3, 4], [4, 2], [2, 1], [1, 3], [2, 5],
[4, 4], [3, 2], [2, 4], [4, 5], [3, 3], [4, 1], [2, 2], [1, 4], [3, 5],
[4, 3], [3, 1], [1, 2]]

Yes

?- knightstour(5,4,5,4,K).

K = [[5, 4], [4, 2], [3, 4], [5, 3], [4, 1], [2, 2], [1, 4], [3, 3],
[2, 1], [1, 3], [3, 2], [5, 1], [4, 3], [2, 4], [1, 2], [3, 1], [5, 2],
[4, 4], [2, 3], [1, 1]]

Yes

?- knightstour(5,5,1,1,K).

K = [[1, 1], [2, 3], [3, 5], [5, 4], [4, 2], [2, 1], [3, 3], [1, 4],
[2, 2], [4, 1], [5, 3], [4, 5], [2, 4], [1, 2], [3, 1], [5, 2], [4, 4],
[2, 5], [1, 3], [3, 2], [5, 1], [4, 3], [5, 5], [3, 4], [1, 5]]

?- knightstour(3,7,1,1,K).

K = [[1, 1], [2, 3], [3, 1], [1, 2], [3, 3], [2, 1], [1, 3], [3, 2],
[2, 4], [3, 6], [1, 7], [2, 5], [3, 7], [1, 6], [3, 5], [2, 7], [1,
5], [3, 4], [2, 6], [1, 4], [2, 2]] ;

K = [[1, 1], [2, 3], [3, 1], [1, 2], [3, 3], [2, 1], [1, 3], [3, 2],
[2, 4], [3, 6], [1, 7], [2, 5], [3, 7], [1, 6], [3, 5], [2, 7], [1,
5], [3, 4], [2, 2], [1, 4], [2, 6]] ;

K = [[1, 1], [2, 3], [3, 1], [1, 2], [3, 3], [2, 1], [1, 3], [3, 2],
[2, 4], [1, 6], [3, 7], [2, 5], [1, 7], [3, 6], [1, 5], [2, 7], [3,
5], [1, 4], [2, 6], [3, 4], [2, 2]] ;

K = [[1, 1], [2, 3], [3, 1], [1, 2], [3, 3], [2, 1], [1, 3], [3, 2],
[2, 4], [1, 6], [3, 7], [2, 5], [1, 7], [3, 6], [1, 5], [2, 7], [3,
5], [1, 4], [2, 2], [3, 4], [2, 6]] ;

$K = [(1, 1), (3, 2), (2, 4), (3, 6), (1, 7), (2, 5), (3, 7), (1, 6), (3, 5), (2, 7), (1, 5), (2, 3), (3, 1), (1, 2), (3, 3), (2, 1), (1, 3), (3, 4), (2, 6), (1, 4), (2, 2)] ;$

$K = [(1, 1), (3, 2), (2, 4), (3, 6), (1, 7), (2, 5), (3, 7), (1, 6), (3, 5), (2, 7), (1, 5), (2, 3), (3, 1), (1, 2), (3, 3), (2, 1), (1, 3), (3, 4), (2, 2), (1, 4), (2, 6)] ;$

$K = [(1, 1), (3, 2), (2, 4), (1, 6), (3, 7), (2, 5), (1, 7), (3, 6), (1, 5), (2, 7), (3, 5), (2, 3), (3, 1), (1, 2), (3, 3), (2, 1), (1, 3), (3, 4), (2, 6), (1, 4), (2, 2)] ;$

$K = [(1, 1), (3, 2), (2, 4), (1, 6), (3, 7), (2, 5), (1, 7), (3, 6), (1, 5), (2, 7), (3, 5), (2, 3), (3, 1), (1, 2), (3, 3), (2, 1), (1, 3), (3, 4), (2, 2), (1, 4), (2, 6)] ;$

No

?- knightstour(7,3,1,1,K).

$K = [(1, 1), (2, 3), (4, 2), (6, 3), (7, 1), (5, 2), (7, 3), (6, 1), (5, 3), (7, 2), (5, 1), (3, 2), (1, 3), (2, 1), (3, 3), (1, 2), (3, 1), (4, 3), (6, 2), (4, 1), (2, 2)]$

Yes

?- knightstour(7,3,3,2,K).

No

?- knightstour(7,3,3,3,K).

K = [[3, 3], [1, 2], [3, 1], [2, 3], [1, 1], [3, 2], [1, 3], [2, 1], [4, 2], [6, 3], [7, 1], [5, 2], [7, 3], [6, 1], [5, 3], [7, 2], [5, 1], [4, 3], [6, 2], [4, 1], [2, 2]]

Yes

?- knightstour(6,6,1,1,K).

K = [[1, 1], [2, 3], [3, 5], [5, 6], [6, 4], [4, 5], [6, 6], [5, 4], [4, 6], [6, 5], [5, 3], [6, 1], [4, 2], [6, 3], [5, 5], [3, 6], [1, 5], [3, 4], [2, 6], [1, 4], [2, 2], [4, 1], [6, 2], [4, 3], [5, 1], [3, 2], [4, 4], [2, 5], [1, 3], [2, 1], [3, 3], [5, 2], [3, 1], [1, 2], [2, 4], [1, 6]]

Yes

?- knightstour(4,7,1,1,K).

K = [[1, 1], [2, 3], [4, 4], [3, 6], [1, 7], [2, 5], [4, 6], [2, 7], [1, 5], [3, 4], [4, 2], [2, 1], [1, 3], [3, 2], [2, 4], [4, 5], [3, 7], [1, 6], [3, 5], [4, 7], [2, 6], [1, 4], [2, 2], [4, 3], [3, 1], [1, 2], [3, 3], [4, 1]]

Yes

app([], U, U).

app([H | T], U, [H | W]) :- app(T, U, W).

rev([],[]) :- !.

rev([H | T], L) :- rev(T, L1), app(L1, [H], L).

% member(X, [X | Y]) :- !. This is built-in

% member(X, [H | Y]) :- member(X, Y).

% last(X, [X]) :- !. This is built-in

% last(L, [H | T]) :- last(L, T).

first(X, [X]) :- !.

first(H, [H | T]).

$\text{kmove}(R1,C1,R2,C2,NR,NC) :-$

$R2 \text{ is } R1+1, C2 \text{ is } C1+2, \text{onboard}(R2,C2,NR,NC).$

$\text{kmove}(R1,C1,R2,C2,NR,NC) :-$

$R2 \text{ is } R1+2, C2 \text{ is } C1+1, \text{onboard}(R2,C2,NR,NC).$

$\text{kmove}(R1,C1,R2,C2,NR,NC) :-$

$R2 \text{ is } R1-1, C2 \text{ is } C1+2, \text{onboard}(R2,C2,NR,NC).$

$\text{kmove}(R1,C1,R2,C2,NR,NC) :-$

$R2 \text{ is } R1-2, C2 \text{ is } C1+1, \text{onboard}(R2,C2,NR,NC).$

$\text{kmove}(R1,C1,R2,C2,NR,NC) :-$

$R2 \text{ is } R1+1, C2 \text{ is } C1-2, \text{onboard}(R2,C2,NR,NC).$

$\text{kmove}(R1,C1,R2,C2,NR,NC) :-$

$R2 \text{ is } R1+2, C2 \text{ is } C1-1, \text{onboard}(R2,C2,NR,NC).$

$\text{kmove}(R1,C1,R2,C2,NR,NC) :-$

$R2 \text{ is } R1-1, C2 \text{ is } C1-2, \text{onboard}(R2,C2,NR,NC).$

$\text{kmove}(R1,C1,R2,C2,NR,NC) :-$

$R2 \text{ is } R1-2, C2 \text{ is } C1-1, \text{onboard}(R2,C2,NR,NC).$

$\text{onboard}(R,C,NR,NC) :- 0 < R, R = < NR, 0 < C, C = < NC.$

knightstour(NR,NC,R,C,KT) :-

 Nsq is NR*NC,

 kt(1, [[R,C]], Nsq, Moves, NR, NC),

 rev(Moves, KT).

kt(Nsq, M, Nsq, M, NR, NC).

kt(I, [[R,C] | Rest], Nsq, Moves, NR, NC) :-

 kmove(R,C,NewR,NewC,NR,NC),

 not member([NewR,NewC], [[R,C] | Rest]),

 I1 is I+1,

 kt(I1, [[NewR,NewC], [R,C] | Rest], Nsq, Moves, NR,NC).

reKNIGHTSTOUR(NR,NC,R,C,ReeKT) :-

Nsq is NR*NC,

rekt(1, [[R,C]], Nsq, ReeKT, NR, NC).

rekt(Nsq, [[LR,LC] | Rest], Nsq, ReeKT, NR, NC) :-

last([R1,C1], [[LR,LC] | Rest]),

kmove(LR,LC,R1,C1,NR,NC),

rev([[R1,C1], [LR,LC] | Rest], ReeKT).

rekt(I, [[R,C] | Rest], Nsq, Moves, NR, NC) :-

kmove(R,C,NewR,NewC,NR,NC),

not member([NewR,NewC], [[R,C] | Rest]),

I1 is I+1,

rekt(I1, [[NewR,NewC], [R,C] | Rest], Nsq, Moves, NR,NC).