First of copy of

g= CartesianProduct(CycleGraph(6), PathGraph(6)) in its GraphPower(g,3) where k=3 here

(2,1) to (5,1) edge form a cycle in the third power but (2,1) to (1,6) no edge in third power so along one side it is a cycle and another it is a path and hence

So along rows cycle and so along columns Path here I have removed

(2, 1)	(1, 2)	(2, 3)	(1, 4)	(2, 5)	(1, 6)
(1, 1)	(3, 2)	(1, 3)	(3, 4)	(1, 5)	(3, 6)
(4, 1)	(2, 2)	(4, 3)	(2, 4)	(4, 5)	(2, 6)
(3, 1)	(5, 2)	(3, 3)	(5, 4)	(3, 5)	(5, 6)
(6, 1)	(4, 2)	(6, 3)	(4, 4)	(6, 5)	(4, 6)
(5, 1)	(6, 2)	(5, 3)	(6, 4)	(5, 5)	(6, 6)

Second copy

(1, 1)	(2, 2)	(1, 3)	(2, 4)	(1, 5)	(2, 6)
(3, 1)	(1, 2)	(3, 3)	(1, 4)	(3, 5)	(1, 6)
(2, 1)	(4, 2)	(2, 3)	(4, 4)	(2, 5)	(4, 6)
(5, 1)	(3, 2)	(5, 3)	(3, 4)	(5, 5)	(3, 6)
(4, 1)	(6, 2)	(4, 3)	(6, 4)	(4, 5)	(6, 4)
(6, 1)	(5, 2)	(6, 3)	(5, 4)	(6, 5)	(5, 6)

Third copy

(1, 1)	(1, 3)	(1, 6)	(1, 4)	(1, 2)	(1, 5)
(2, 3)	(2, 5)	(2, 2)	(2, 6)	(2, 4)	(2, 1)
(3, 5)	(3, 1)	(3, 4)	(3, 2)	(3, 6)	(3, 3)
(4, 1)	(4, 3)	(4, 6)	(4, 4)	(4, 2)	(4, 5)
(5, 3)	(5, 5)	(5, 2)	(5, 6)	(5, 4)	(5, 1)
(6, 5)	(6, 1)	(6, 4)	(6, 2)	(6, 6)	(6, 3)

Fourth copy

(1, 1)	(1, 2)	(1, 3)	(1, 4)	(1, 5)	(1, 6)
(2, 5)	(2, 6)	(2, 1)	(2, 2)	(2, 3)	(2, 4)
(3, 3)	(3, 4)	(3, 5)	(3, 6)	(3, 1)	(3, 2)
(4, 1)	(4, 2)	(4, 3)	(4, 4)	(4, 5)	(4, 6)
(5, 5)	(5, 6)	(5, 1)	(5, 2)	(5, 3)	(5, 4)
(6, 3)	(6, 4)	(6, 5)	(6, 6)	(6, 1)	(6, 2)

So four copies is the maximum number of copies of $P_n \square C_m \; into (P_n \square C_m)^3$

Which I had done a non-trivial example you put the edges in different colors and see sir

Their may be some left over edges but we need the maximum number of copies possible its edges.