

# Physics 2605H: Worksheet I

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## Problem 1.

- (a) If X chooses to measure  $X_3$ , in (3,1), what would be the classical states in each of the occupied states?
- (b) Give examples for per position states in the figure?
- (c) Are the states entangled? Why do you think so?

## Solution 1.

- (a) (3,1) collapses to  $X_3$   
(3,3) collapses to  $O_2$   
(1,1) collapses to  $X_1$   
(1,2) collapses to  $O_4$
- (b)  $X_1$  is entangled with  $O_2$   
 $O_2$  is entangled with  $X_3$   
 $X_3$  is entangled with  $O_4$   
 $O_4$  is entangled with  $X_1$
- (c) Yes, every state is entangled because collapsing any state will result in the collapse of all other states.

## Problem 2.

- (a) X will win. Regardless of how O plays (2,1) is guaranteed to be X.
- (b) Not really, you could force a tie by measuring  $O_8$  in (3,2).

## Solution 2.

**Problem 3.** Provide the game log which leads to following result or something similar.

**Solution 3.** Filling in the grid in a spiral starting from (1,1) we get:

Cyclic loop occurs!!

Block\_1 collapsed (Measure)

Block\_2 collapsed (  $X_2 : [1 \rightarrow 2]$  )

Block\_3 collapsed (  $O_3 : [2 \rightarrow 3]$  )

Block\_6 collapsed (  $X_4 : [3 \rightarrow 6]$  )

Block\_9 collapsed (  $O_5 : [6 \rightarrow 9]$  )

Block\_8 collapsed (  $X_6 : [9 \rightarrow 8]$  )

Block\_7 collapsed (  $O_7 : [8 \rightarrow 7]$  )

Block\_4 collapsed (  $X_8 : [7 \rightarrow 4]$  )

Block\_5 collapsed (  $O_9 : [4 \rightarrow 5]$  )

Game Over !!