

Mathematics of Probability / Superposition and Measurement Homework Questions

1. Sandra and Ayesha are playing a board game. They are playing with 1 standard 6-sided die.
    a. Sandra needs to move her piece 4 spaces to win the game. She must roll exactly 4 to win in this round.
        i. What is the probability that Sandra will roll a 4 and win? (⅙ or 0.167)
        ii. What is the probability that Sandra will not roll a 4? (⅚ or 0.833)

    b. If Ayesha rolls exactly 6, she has to go back to the start of the game.
        i. What is the probability that Ayesha will roll a 6 and have to go back to the start? (⅙ or 0.167)
        ii. What is the probability that Ayesha will not roll a 6? (⅚ or 0.833)

    c. What is the probability that Sandra will **not** win and Ayesha will **go back to the start** of the game? (⅚ * ⅙ = 0.139)
    d. What is the probability that Sandra will win and Ayesha will **not go back to the start** of the game? (⅙ * ⅚ = 0.139)
    e. What is the most likely outcome of this round?
        i. Sandra wins, Ayesha goes back to the start
        ii. Sandra does not win, Ayesha goes back to the start
        iii. Sandra wins, Ayesha does not go back to the start
        iv. Sandra does not win, Ayesha does not go back to the start (correct answer, 25/36 or 0.694)

2. Avion has a bag of candies. He counted the number of candies of each color and found that his bag is 24% blue, 20% orange, 16% green, 15% yellow, 14% red, and 13% brown.
    a. If he picks one candy from the bag, which color is he most likely to choose?
        i. Blue (correct)
        ii. Orange
        iii. Green
        iv. Yellow
        v. Red
        vi. Brown
    b. If he picks one candy from the bag, which color is he least likely to choose?
        i. Blue
        ii. Orange
        iii. Green
        iv. Yellow
        v. Red
        vi. Brown (correct)

A qubit is a superposition of how many values?

a) 0
b) 1
c) 2
d) unknown until measurement occurs

What information is held in the quantum state?

a) each possible outcome after measurement
b) phase
c) the probability of measuring one outcome over another
d) all of the above

Select all possible values of a qubit after measurement.

a) 0
b) 1
c) a superposition of $|0\rangle$ or $|1\rangle$

Quantum operations can be used to change the _____ of measuring one outcome over another.

a) superposition
b) probability
c) phase
d) qubit

(photo credit: Jen Palmer)

The utensil above is an example of an object in a state of superposition. (true / false)

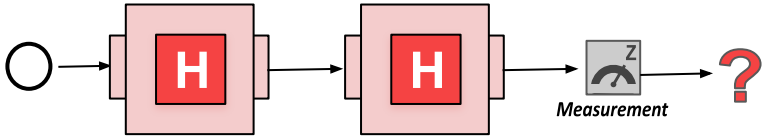
I think this because, _____ .

a) It can be measured with a ruler

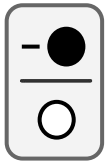
b) It is a combination of both a spoon and a knife

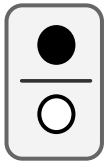
c) It makes a much better spoon than knife

d) I don't have any information about the phase



The outcome of this circuit will be:

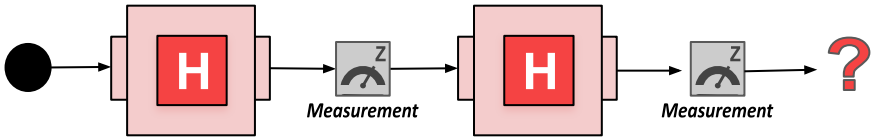
A. 

B. 

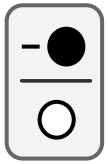
C. ○

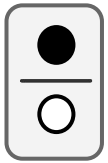
D. ●

E. The outcome cannot be determined



The outcome of this circuit will be:

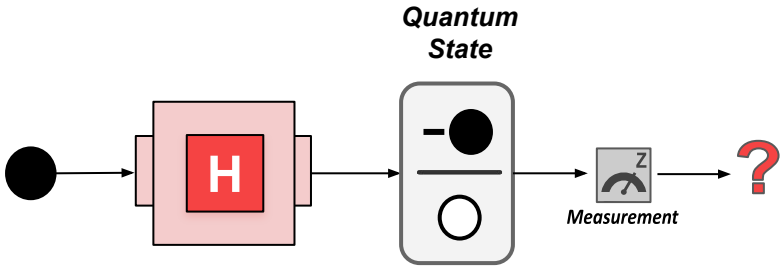
A. 

B. 

C. ○

D. ●

E. The outcome cannot be determined



What information held in the quantum state shown above is lost by the act of measurement? Select all that apply.

a) information about phase
b) the original input value
c) information about probability
d) the ancilla bit

Consider the following act of measurement:

Taking someone's temperature 

What is the measurement device?

a) The person's forehead
b) An infrared thermometer
c) The person's temperature
d) No measurement occured

This method of measurement changes the state of the object being measured.
(true / false)