Quiz
Topological Gates

Q1. How do you write the following braiding sequence as a Python list for the course's simulator?

$$\sigma_1 \sigma_2^{-1} \sigma_1^{-1} \sigma_2$$

1. `[[2, 1], [1, -1], [2, -1], [1, 1]]` (True)

2. `[[1, 1], [2, -1], [1, -1], [2, 1]]`

3. `[[1, 2], [1, 1], [-1, 2], [1, 1]]`

4. `[[1, 1], [1, 2], [-1, 1], [1, 2]]`

Q2. What is the inverse of this braiding sequence?

$$\sigma_1 \sigma_2^{-1} \sigma_1^{-1} \sigma_2$$

1. $\sigma_2^{-1} \sigma_1 \sigma_2 \sigma_1^{-1}$ (True)

2. $\sigma_1 \sigma_2^{-1} \sigma_1^{-1} \sigma_2$

3. $\sigma_1^{-1} \sigma_2 \sigma_1 \sigma_2^{-1}$

4. $\sigma_1 \sigma_2 \sigma_1 \sigma_2$

Q3. σ_1 is:

1. the braiding between anyon 1 and anyon 2 in the clockwise direction. (True)

2. the braiding between anyon 1 and anyon 2 in the counterclockwise direction.

3. the braiding between anyon 2 and anyon 3 in the clockwise direction.

4. the braiding between anyon 2 and anyon 3 in the counterclockwise direction.

Q4. σ_3^{-1} is:

1. the braiding between anyon 3 and anyon 4 in the counterclockwise direction. (True)

2. the braiding between anyon 3 and anyon 4 in the clockwise direction.

3. the braiding between anyon 2 and anyon 3 in the clockwise direction.

4. the braiding between anyon 2 and anyon 3 in the counterclockwise direction.

Q5.   What could we say about braiding operations?
(Check The correct statements)

1. Braiding operator can be represented as a unitary matrix. (True)

2. It is possible to braid anyon 1 with anyon 3.

3. Braiding operators are self-adjoint matrices ($\sigma_i = \sigma_i^\dagger$).

4. Given 4 anyons, there are 6 elementary braiding operations. (True)

Q6.   Check The correct statements:

1. Fibonacci braiding operations are universal.(True)

2. We can approximate a Hadamard gate using 3 Fibonacci anyons. (True)

3. We cannot approximate T gate using 3 Fibonacci anyons.

4. We cannot approximate the F matrix using 3 Fibonacci anyons.

Q7.   Which one of these relations is the Yang-Baxter relation?

1. $\sigma_1\sigma_2\sigma_1 = \sigma_2\sigma_1\sigma_2$ (True)

2. $\sigma_1\sigma_2 = \sigma_2\sigma_1$

3. $\sigma_1 = F\sigma_2 F^\dagger$

4. $\sigma_1^{10} = 1$

Q8.   What is the periodicity of Fibonacci braiding operations?

1. $\sigma_1^{10} = \sigma_2^{10} = I$ (True)

2. $\sigma_1^5 = \sigma_2^5 = I$

3. $\sigma_1^2 = \sigma_2^2 = I$

4. $\sigma_1^9 = \sigma_2^9 = I$

Q9.   Which one of these algorithms can approximate a quantum gate in a polylogarithmic time: $O(log^c(1/\epsilon))$?

1. Solovay-Kitaev algorithm. (True)

2. Brute-force algorithm.

3. Machine Learning algorithm.

4. Systematic algorithm.

Q10. $\sigma_1\sigma_2\sigma_1^2\sigma_2\sigma_1 =$

1. $\sigma_2\sigma_1\sigma_2^2\sigma_1\sigma_2$.(True)

2. $\sigma_1^{-1}\sigma_2^{-1}\sigma_1^{-2}\sigma_2^{-1}\sigma_1^{-1}$.

3. $\left(\sigma_1\sigma_2\sigma_1^2\sigma_2\sigma_1\right)^{10}$

4. $\sigma_1\sigma_2\sigma_1\sigma_2\sigma_1$

Q11. $\sigma_1\sigma_2\sigma_1\sigma_2 =$

1. $F\sigma_2\sigma_1\sigma_2\sigma_1 F^\dagger$.(True)
2. $\sigma_2\sigma_1\sigma_2\sigma_1$.
3. $(\sigma_1\sigma_2\sigma_1\sigma_2)^{10}$
4. $(\sigma_1\sigma_2)^2$

Q12. Check The correct statements:

1. Weaving sequence is another name for braiding sequence.
2. Weaving sequences are universal, just like braiding sequences. (True)
3. Given 3 anyons, a weaving sequence is a combination of σ_1^2, σ_2^2 and their inverses. (True)
4. Weaving sequences are easier to implement in experiment than braiding sequences.(True)