Grover

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Algoritmo de Grover

Algoritmo cuántico que busca en una secuencia desordenada más rápido que cualquier algoritmo clásico conocido.

Complejidad:

- Clásico: O(N)
- Grover: O $(\sqrt{N})$

Diseñado inicialmente para buscar un único valor.

Generalizado después para buscar múltiples valores: Amplificación de Amplitud (AA).

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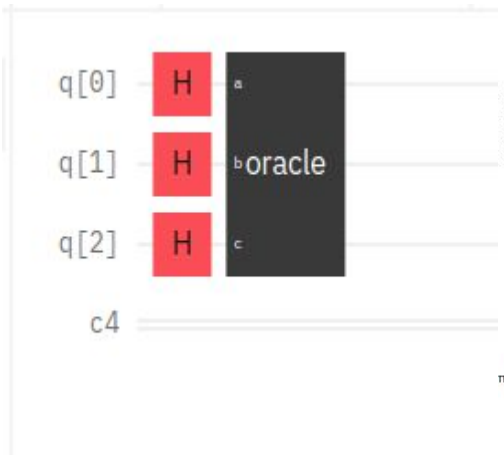
Estructura

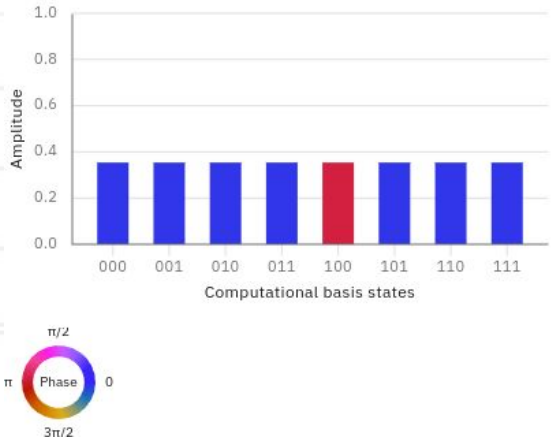
Consta de dos partes:

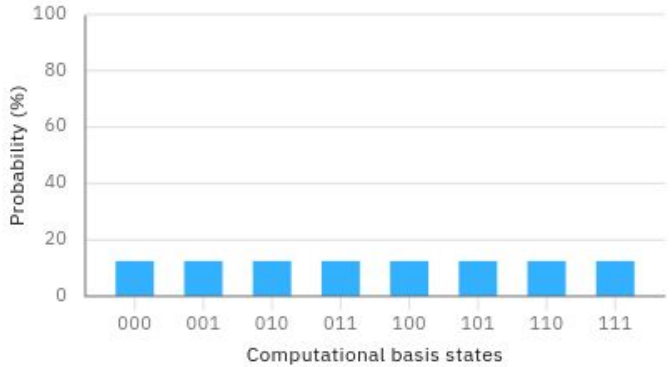
- Oráculo: Circuito que da una fase de π a los valores buscados (marcar).
- Difusor: Circuito que amplifica los estados marcados.

Estructura: Oracle

Oráculo: Circuito que da una fase de π a los valores buscados (marcar).

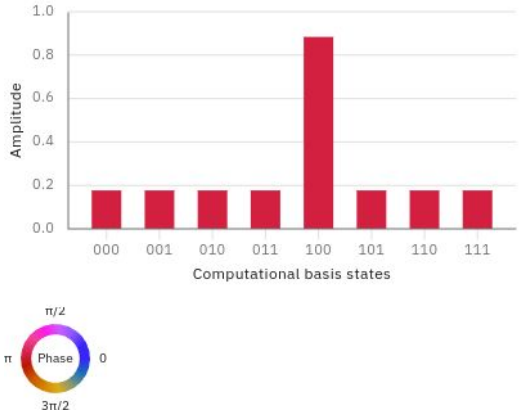


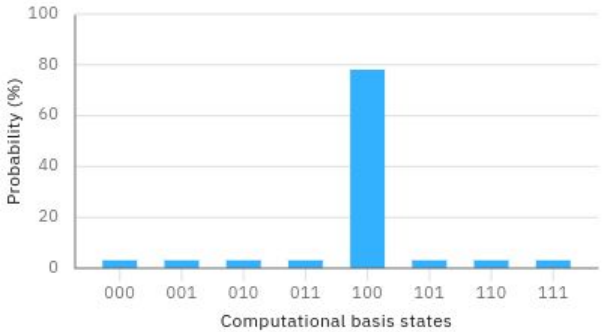




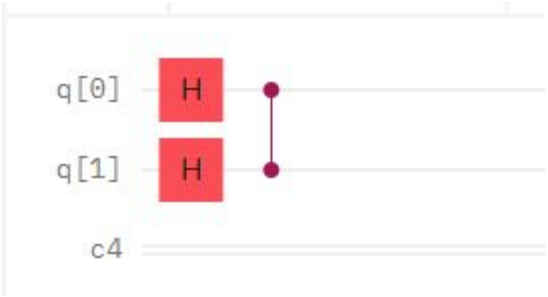
Estructura: Difusor

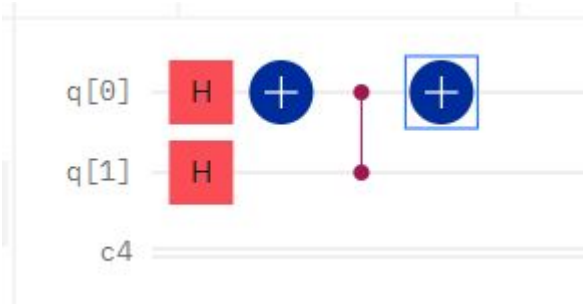
Difusor: Circuito que amplifica los estados marcados.

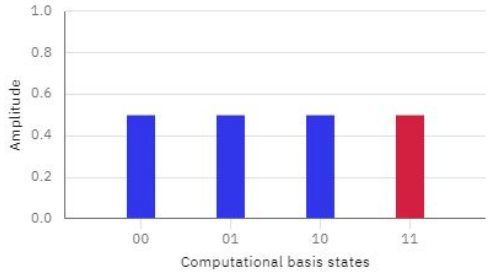


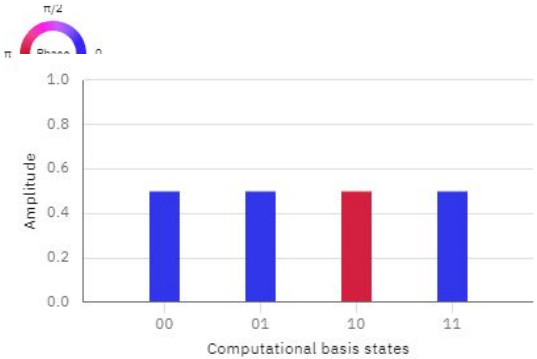


Como armar el Oráculo 2Q?









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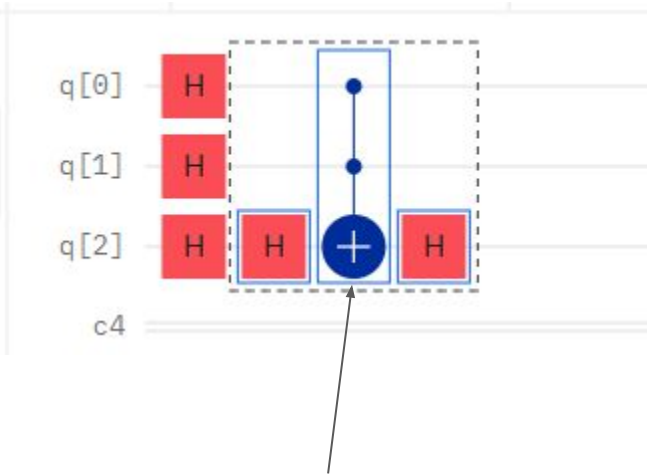
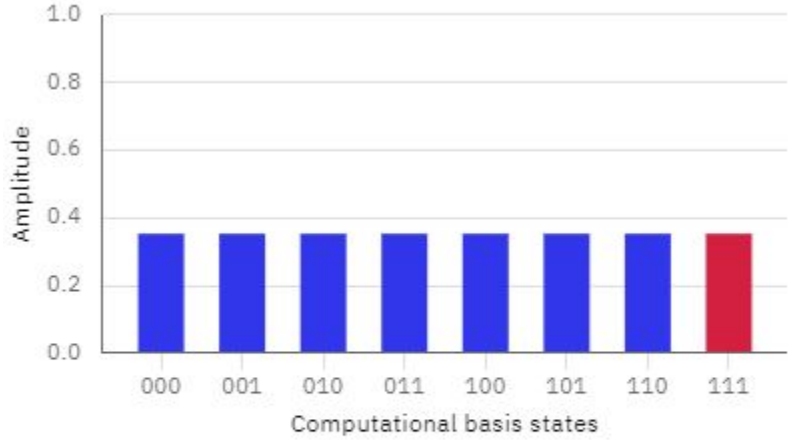
Cómo armar el Oráculo 3Q?



Puerta CCZ



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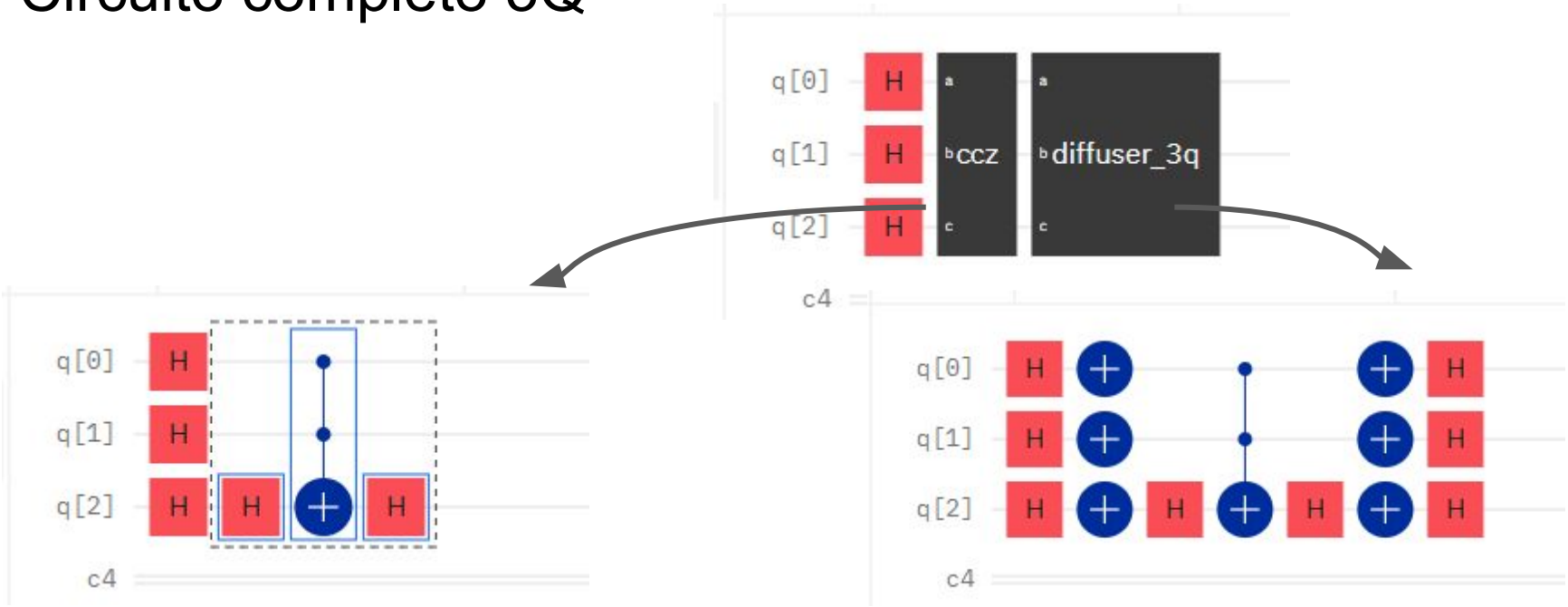
Circuito completo 3Q



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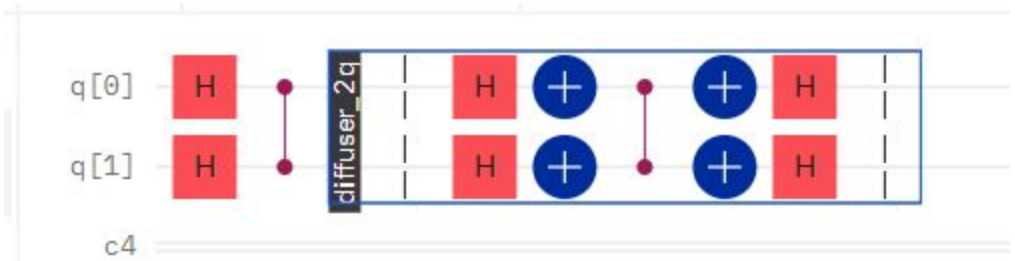
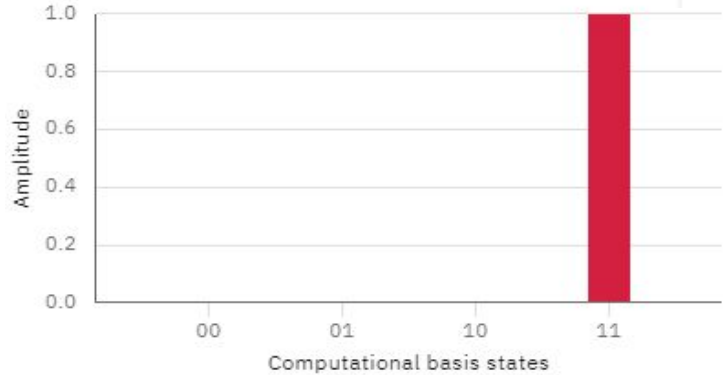
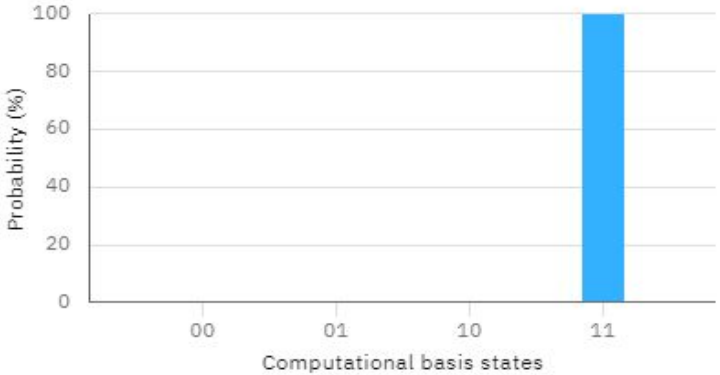
Circuito completo 2Q







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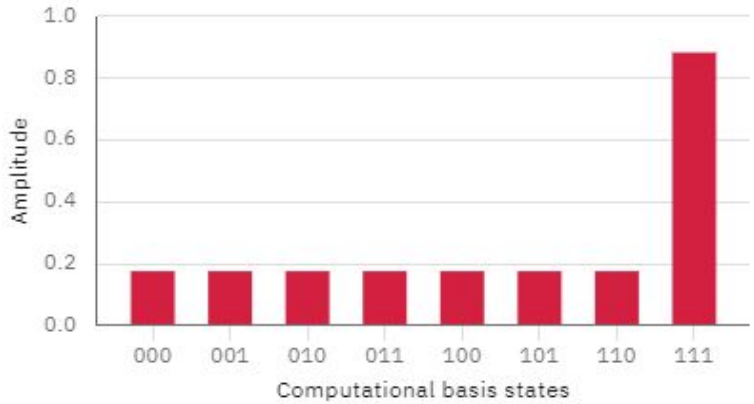

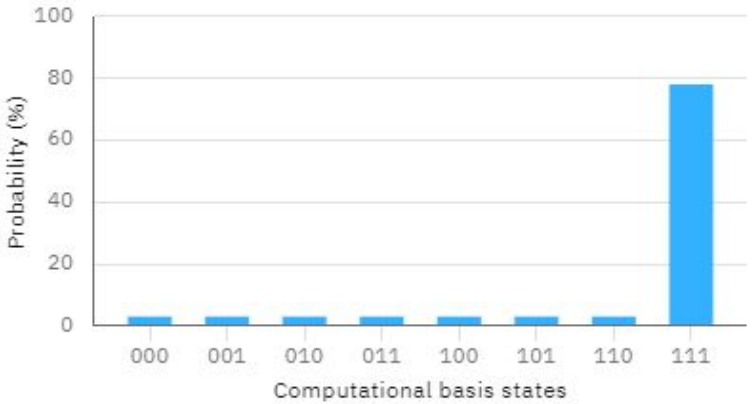

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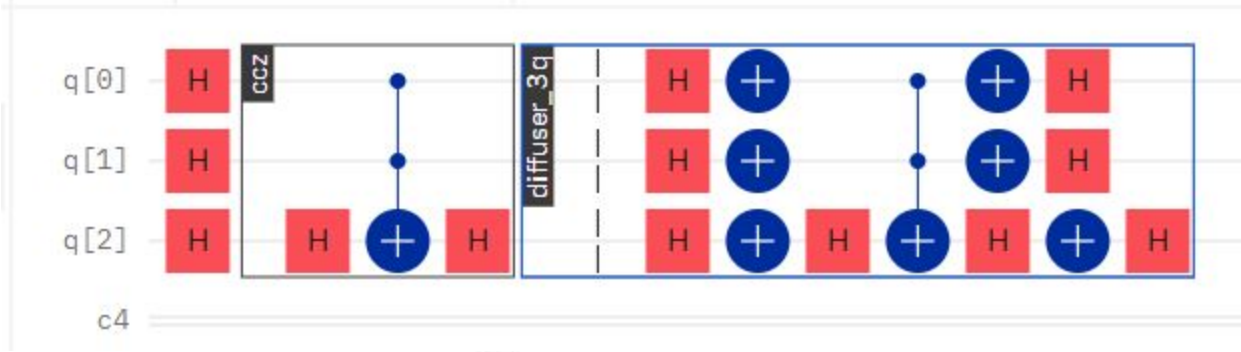

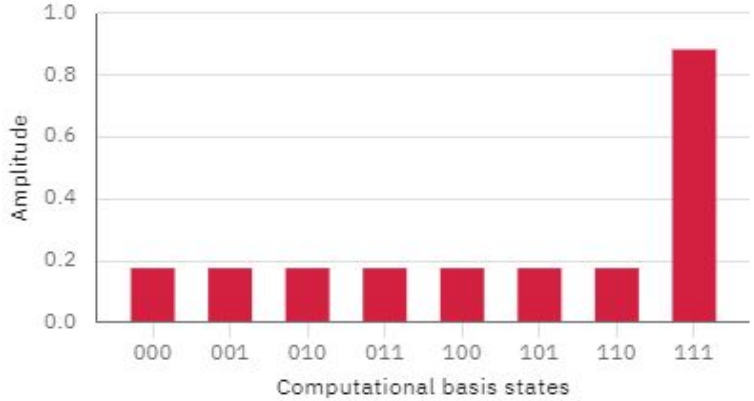

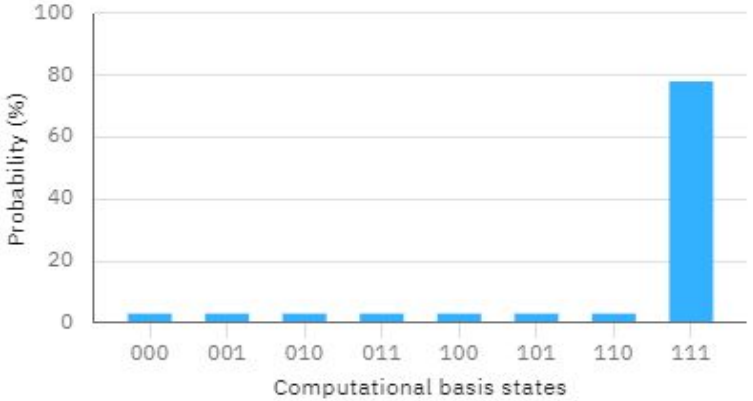

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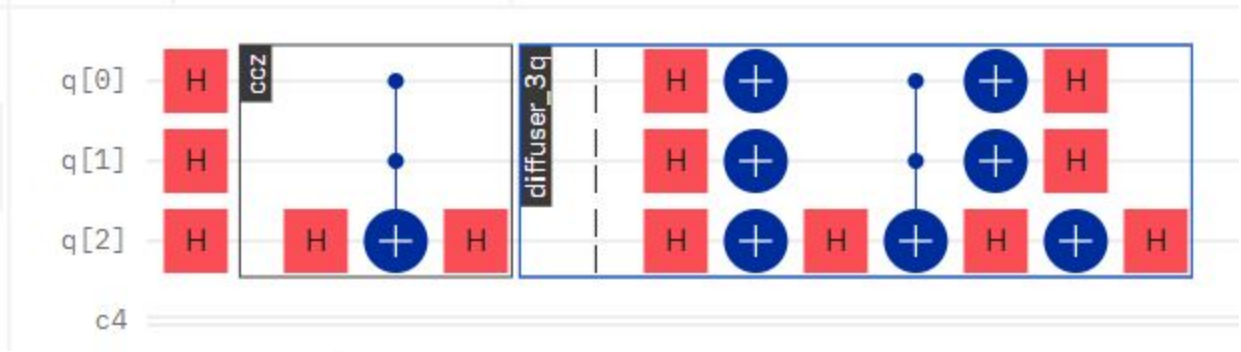

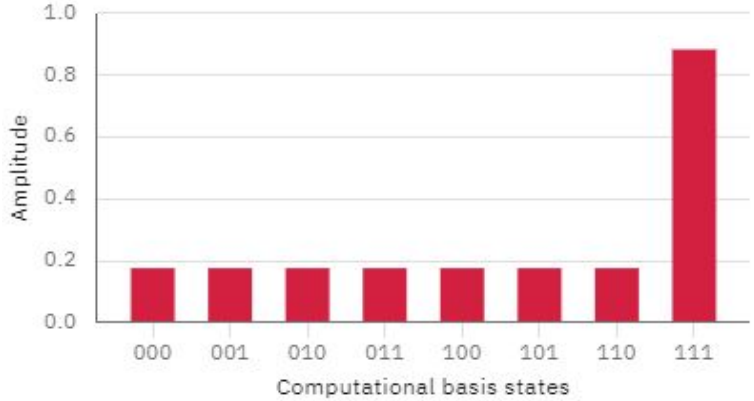

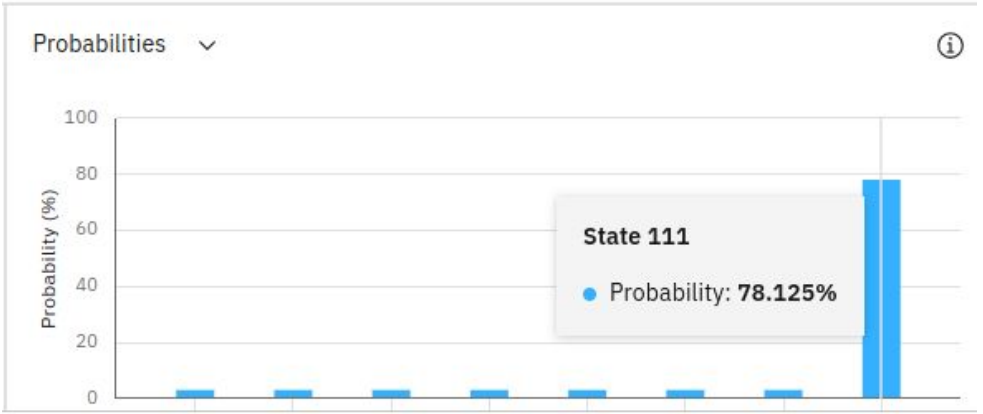

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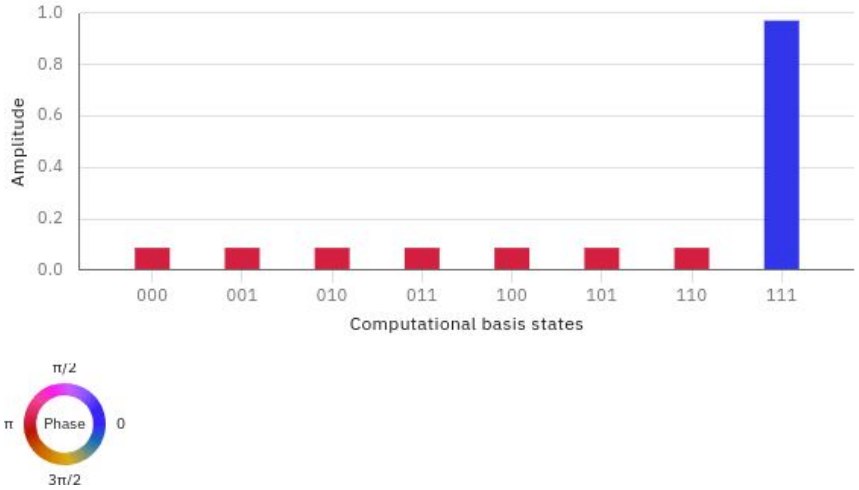

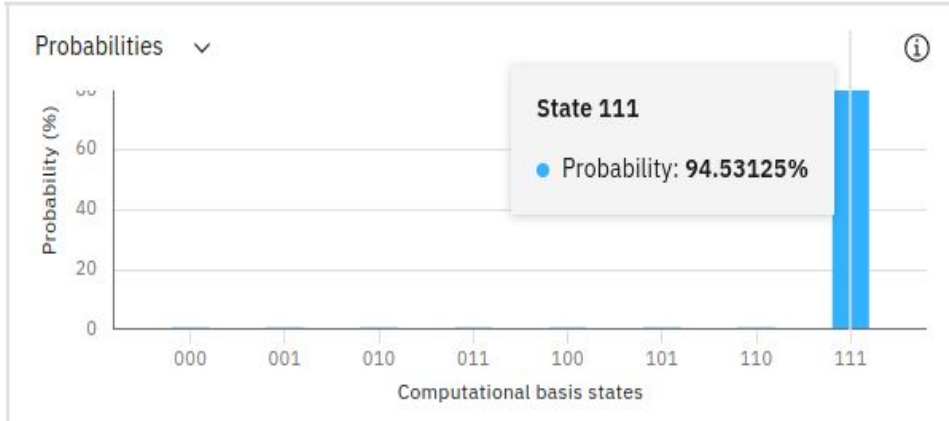

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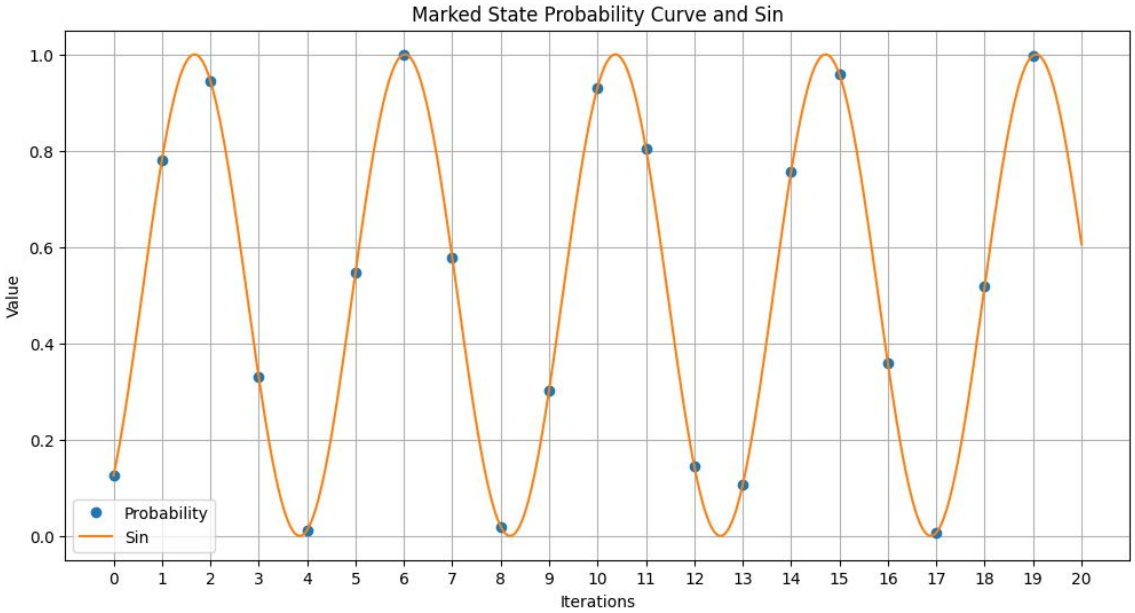
¿Cuántas iteraciones son las óptimas?

$$k = \left\lfloor \frac{\pi}{4}\sqrt{\frac{N}{M}} \right\rfloor$$

Fórmula para determinar la cantidad de iteraciones óptimas: **2**

Prob: 1 estado para 3 Q:

- 0 ite: 0.12500000000000003
- 1 ite: 0.7812500000000001
- 2 ite: 0.9453124999999999
- 3 ite: 0.330078125
- 4 ite: 0.01220703125000009
- 5 ite: 0.5479736328125003
- 6 ite: 0.9997863769531249
- 7 ite: 0.5769729614257806



N= es el número total de estados (usualmente 2^n si tienes n qubits),
M= es el número de estados marcados (objetivos),

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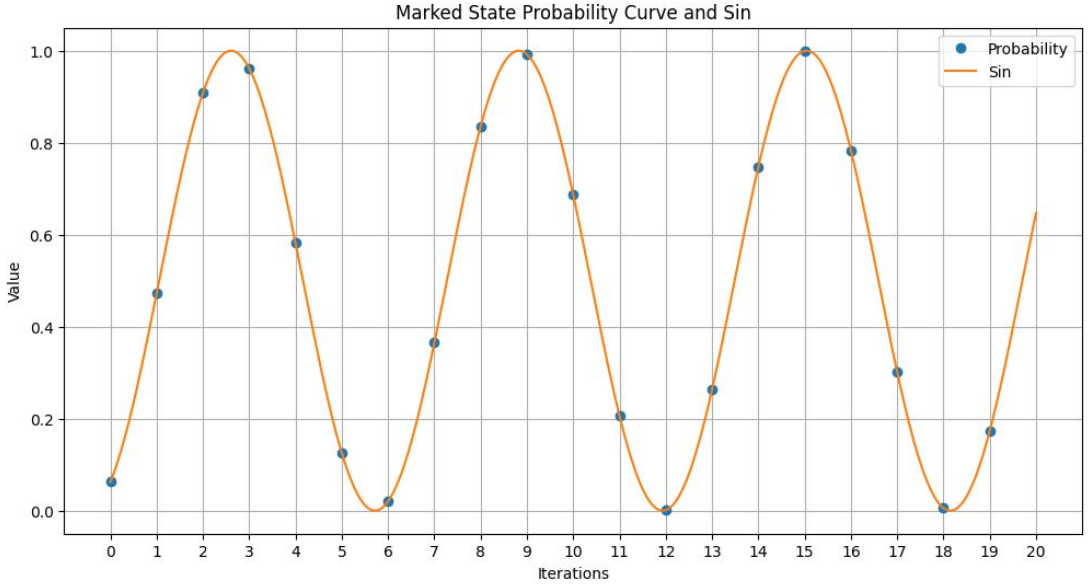
¿Cuántas iteraciones son las óptimas?

Fórmula para determinar la cantidad de iteraciones óptimas: **3**

$$k = \left\lfloor \frac{\pi}{4}\sqrt{\frac{N}{M}} \right\rfloor$$

Prob: 1 estado para 4 Q:

- 0 ite: 0.0625
- 1 ite: 0.47265625
- 2 ite: 0.908447265625
- 3 ite: 0.9613189697265625
- 4 ite: 0.5817041397094724
- 5 ite: 0.1254916787147522
- 6 ite: 0.020380768924951515
- 7 ite: 0.36491288826800855



N= es el número total de estados (usualmente 2^n si tienes n qubits),
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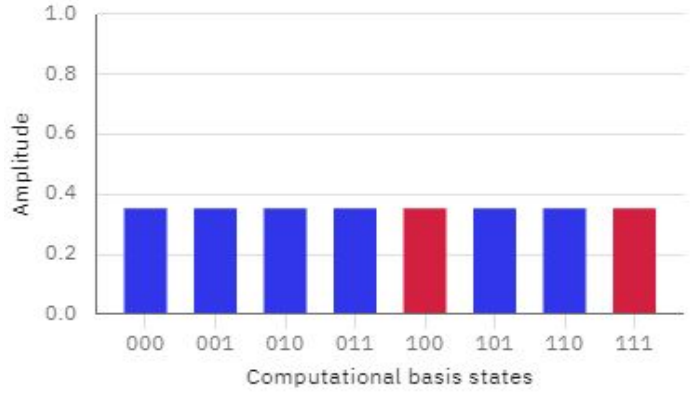
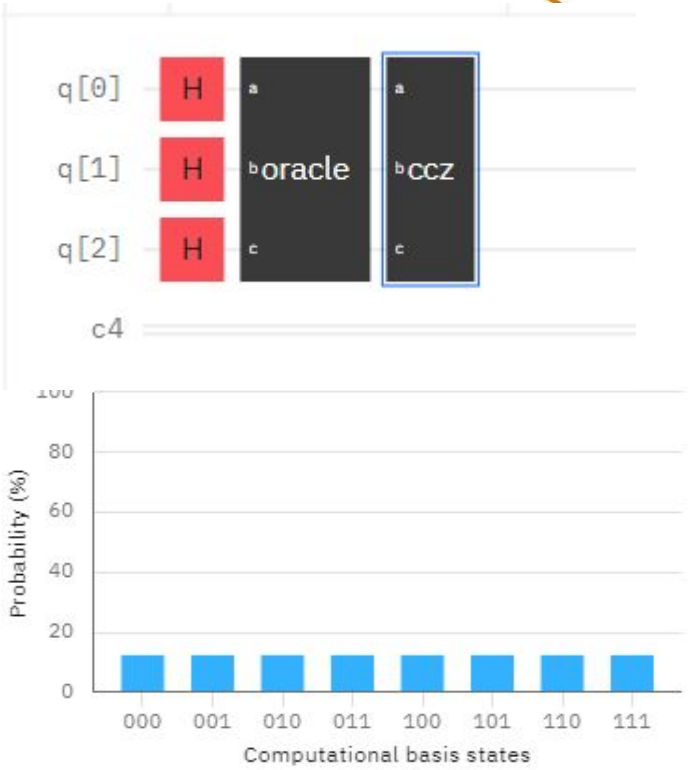
Podemos buscar más de un resultado?





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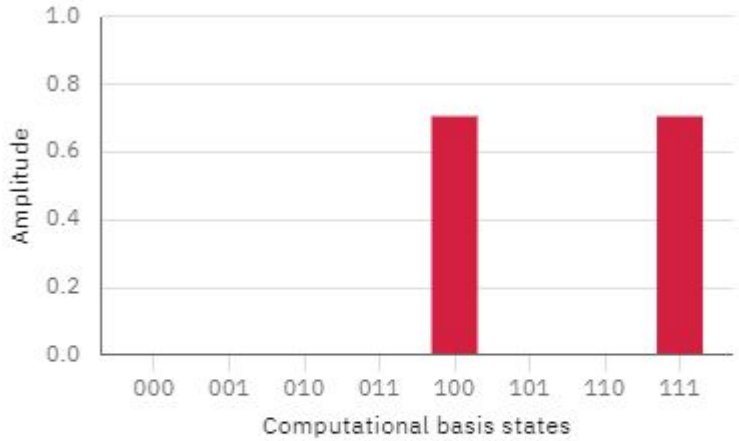

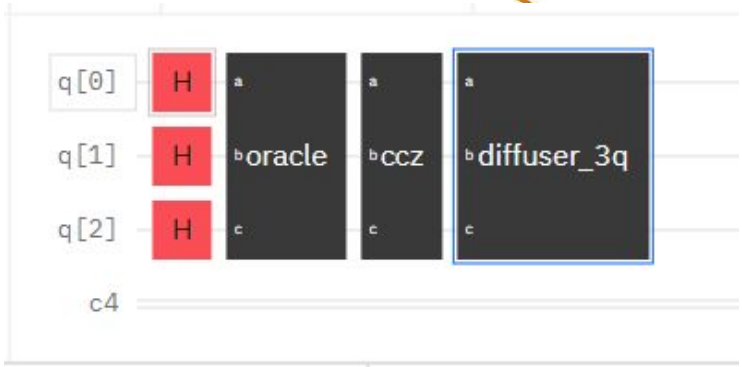

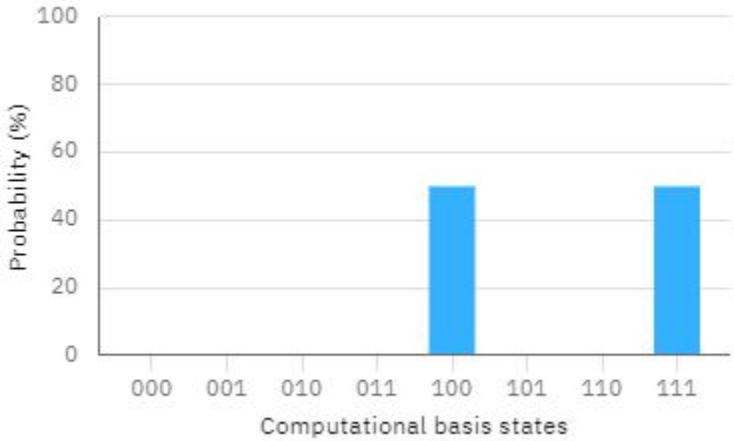

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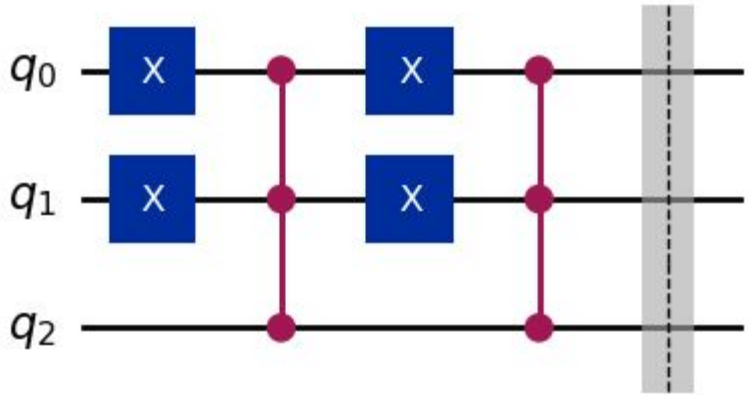
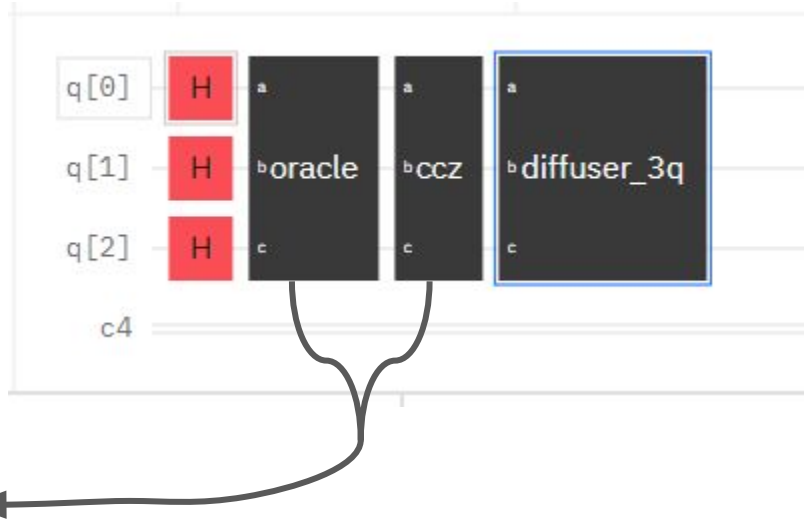
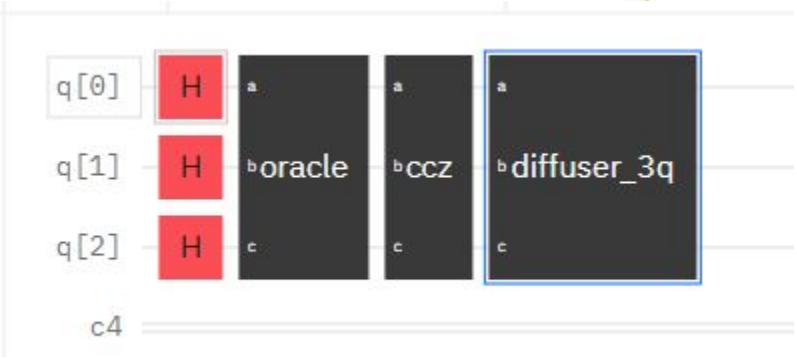
Podemos buscar más de un resultado?

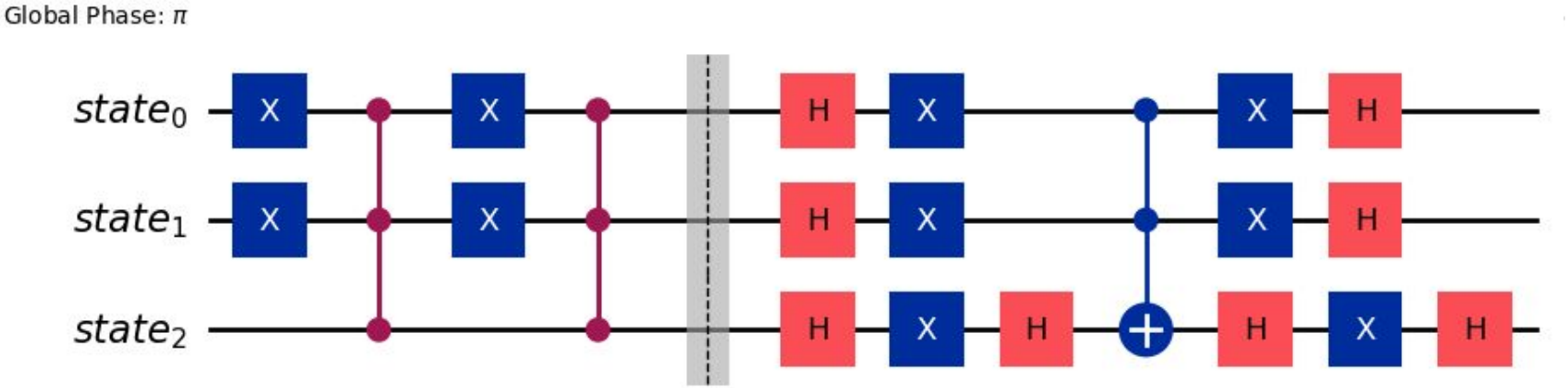




https://shorturl.at/3bSPt

Podemos buscar más de un resultado?

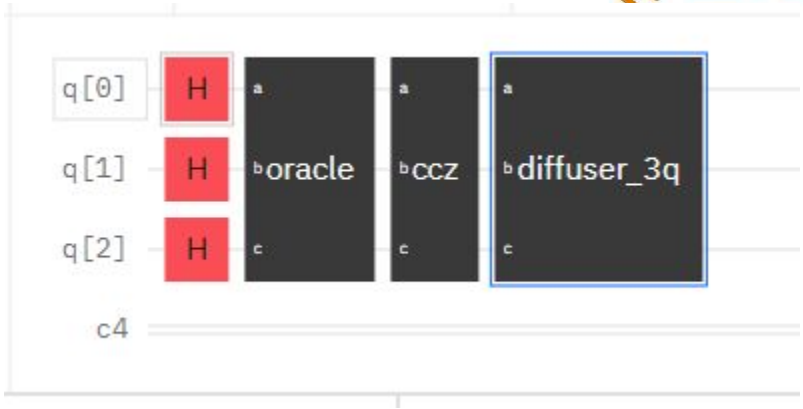


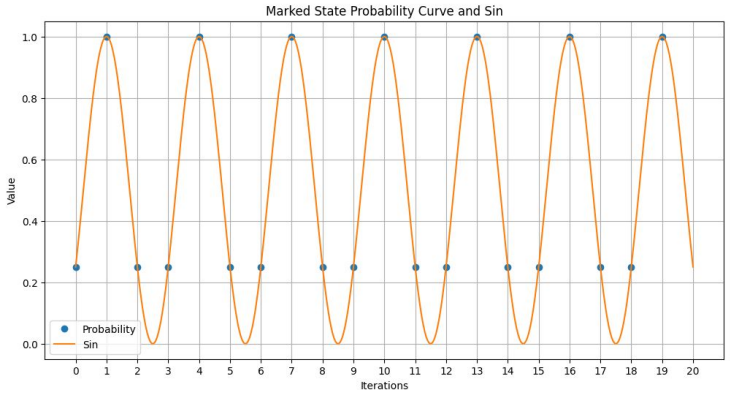


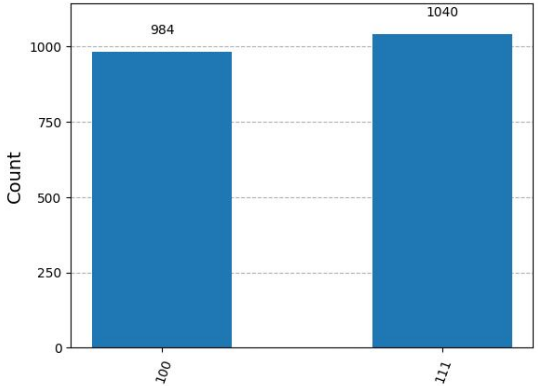
Podemos buscar más de un resultado?

$$k = \left\lfloor \frac{\pi}{4}\sqrt{\frac{N}{M}} \right\rfloor$$

N=8, M=2
=> k=**1**







N= es el número total de estados (usualmente 2^n si tienes n qubits),
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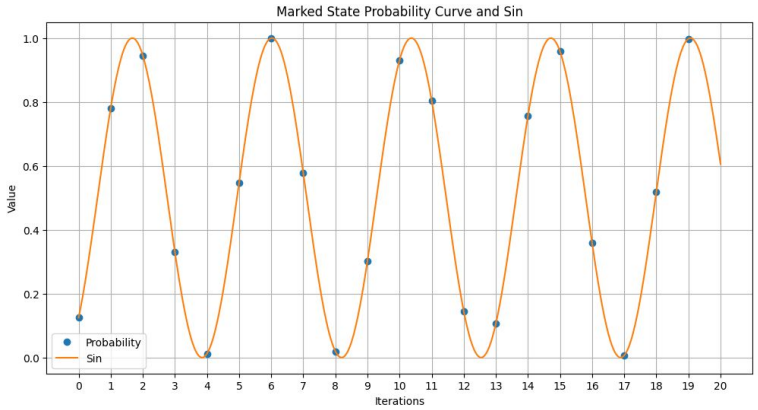
Podemos buscar más de un resultado?

$$k = \left\lfloor \frac{\pi}{4}\sqrt{\frac{N}{M}} \right\rfloor$$

N=16, M=2
=> k=**2**



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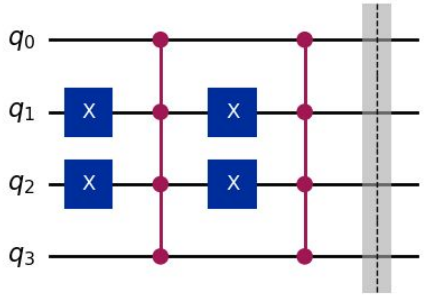

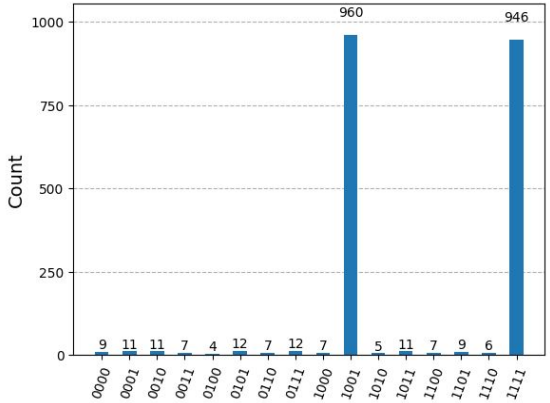

N= es el número total de estados (usualmente 2^n si tienes n qubits),
M= es el número de estados marcados (objetivos),

Lifia

FIN

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