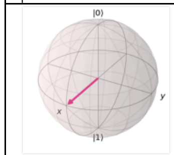
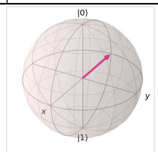
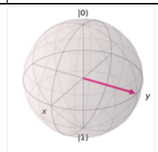
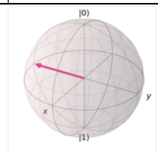
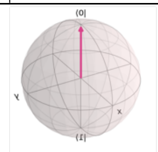
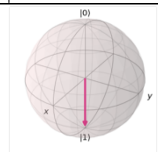
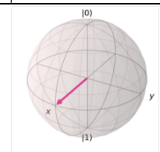
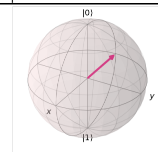
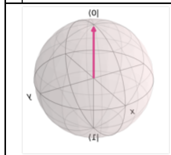
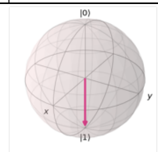
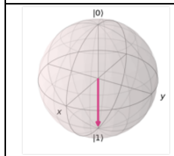
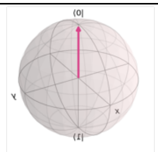
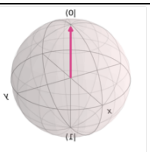
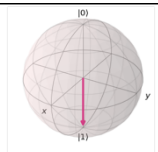
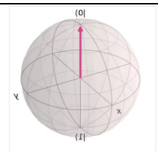
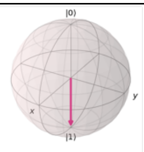
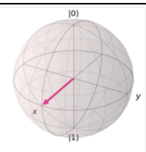
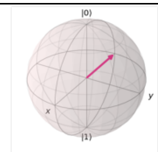
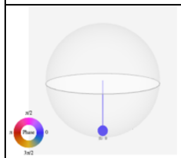
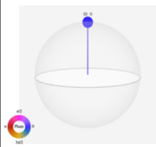
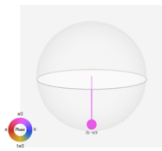
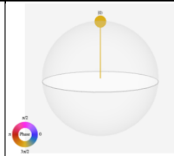
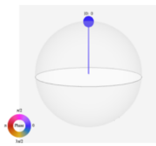
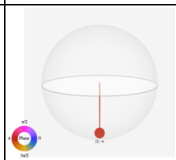
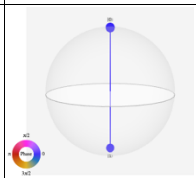
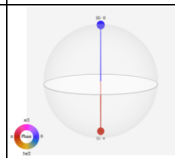
<table>
<tr><td colspan="2">Pauli – X gate</td><td colspan="2">Pauli Y gate</td><td colspan="2">Pauli Z gate</td><td colspan="2">Hadamard Gate</td></tr>
<tr><td colspan="2">NOT gate
Bit-flip</td><td colspan="2">Phase-flip and Bit flip gate</td><td colspan="2">Phase-flip gate</td><td colspan="2">Coin flip
50%-50 % distribution
Qubit is in Superposition state in computational basis</td></tr>
<tr><td colspan="2">X|0> = |1>
X|1> = |0></td><td colspan="2">Y|0>= i|1>
Y|1>= -i|0></td><td colspan="2">Z|0>= |0>
Z|1>= -|1></td><td colspan="2">H|0>= 1/√2(|0>+|1>)
H|1>= 1/√2(|0>-|1>)</td></tr>
<tr><td colspan="2">X=|1><0| + |0><1|</td><td colspan="2">Y=i|1><0>-i|0>|1></td><td colspan="2">Z=|0><0| - |1><1|</td><td colspan="2">$H = \frac{|0\rangle + |1\rangle}{\sqrt{2}} \langle 0| + \frac{|0\rangle - |1\rangle}{\sqrt{2}} \langle 1|$</td></tr>
<tr><td colspan="2">$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$</td><td colspan="2">$\begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}$</td><td colspan="2">$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$</td><td colspan="2">$\frac{1}{\sqrt{2}}\begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$</td></tr>
<tr><td colspan="2">Rotates by π about the X-axis of the bloch sphere</td><td colspan="2">Rotates by π about the Y-axis of the bloch sphere</td><td colspan="2">Rotates by π about the Z-axis of the bloch sphere</td><td colspan="2">Rotation around the axis located at halfway between x and z axis or Half rotation of the Bloch Sphere</td></tr>
<tr><td colspan="2">Standard Basis on the Bloch Sphere</td><td colspan="2">Standard Basis on the Bloch Sphere</td><td colspan="2">Standard Basis on the Bloch Sphere</td><td colspan="2">|+>,|-> are called Polar basis</td></tr>
<tr><td>|+X></td><td>|-X></td><td>|+Y></td><td>|-Y></td><td>|+Z></td><td>|-Z></td><td>|+></td><td>|-></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2" rowspan="3"></td><td colspan="2" rowspan="3"></td><td colspan="2">Computational Basis on the Bloch Sphere</td><td colspan="2" rowspan="3"></td></tr>
<tr><td>|0></td><td>|1></td></tr>
<tr><td></td><td></td></tr>
<tr><td>X|0> = |1></td><td>X|1> = |0></td><td>Y|0>= i|1></td><td>Y|1>= -i|0></td><td>Z|0>= |0></td><td>Z|1>= -|1></td><td>H|0>= 1/√2(|0>+|1>)</td><td>H|1>= 1/√2(|0>-|1>)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">XXX= X
XYX= Y
XZX= Z</td><td colspan="2">YXY=-X
YYY= Y
YZY=-Z</td><td colspan="2">ZXZ=-X
ZYZ=-Y
ZZZ= Z</td><td colspan="2">HXH = Z
HYH = −Y
HZH = X</td></tr>
</table>

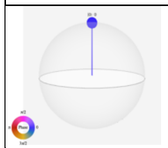
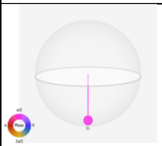
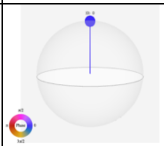
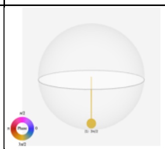
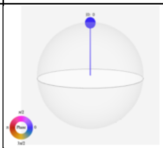
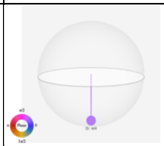
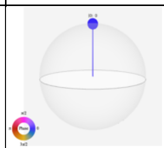
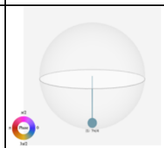
<table>
<tr><th colspan="2">S gate gate</th><th colspan="2">Sdg/ S dagger/ S†</th><th colspan="2">T gate</th><th colspan="2">Tdg gate/ T dagger/ T†</th><th colspan="2">P gate</th></tr>
<tr><td colspan="2">Induces π /2 phase
Square root of Z gate

2√Z-gate

S-gate is not its own inverse

Also called as π /4</td><td colspan="2">Induces - π 2 phase
S dagger is the conjugate transpose(or Hermitian transpose) of the S gate
Inverse of the S gate</td><td colspan="2">Induces π /4 phase
forth root of the Z gate

4√Z-gate

Also called as π /8
$e^{i\frac{\pi}{8}}\begin{bmatrix} e^{-i\frac{\pi}{8}} & 0 \\ 0 & e^{i\frac{\pi}{8}} \end{bmatrix}$</td><td colspan="2">Induces - π /4 phase
T dagger is the conjugate transpose(or Hermitian transpose) of the T gate
Inverse of the T gate</td><td colspan="2">Phase gate
Parametrised gate
Requires a parameters (ϕ)</td></tr>
<tr><td colspan="2">SS=Z
P-gate with ϕ=π/2</td><td colspan="2">S† S† = Z
P-gate with ϕ= -π/2</td><td colspan="2">TTTT=Z
P-gate with ϕ=π/4</td><td colspan="2">T† T† T†T† = Z
P-gate with ϕ= -π/4</td><td colspan="2">P(ϕ)
ϕ is a real number</td></tr>
<tr><td colspan="2">quarter-turn around the Bloch sphere or rotates the qubit by π /2 radians along the z-axis</td><td colspan="2"></td><td colspan="2">rotates the qubit by π /4 radians along the z-axis</td><td colspan="2"></td><td colspan="2">Rotates the qubit with the parameters ϕ around the Z-axis direction.</td></tr>
<tr><td colspan="2">S|0>= |0>
S|1> = i|1></td><td colspan="2">S† |0>= |0>
S† |1> = - i|1></td><td colspan="2">T|0>= |0>
T|1> = i|1></td><td colspan="2">T† |0>= |0>
T† |1> = - i|1></td><td colspan="2">Φ=0, we get identity</td></tr>
<tr><td colspan="2">$\begin{bmatrix} 1 & 0 \\ 0 & e^{\frac{i\pi}{2}} \end{bmatrix}$ or $\begin{bmatrix} 1 & 0 \\ 0 & i \end{bmatrix}$</td><td colspan="2">$\begin{bmatrix} 1 & 0 \\ 0 & e^{-\frac{i\pi}{2}} \end{bmatrix}$ or $\begin{bmatrix} 1 & 0 \\ 0 & -i \end{bmatrix}$</td><td colspan="2">$\begin{bmatrix} 1 & 0 \\ 0 & e^{\frac{i\pi}{4}} \end{bmatrix}$ or $\begin{bmatrix} 1 & 0 \\ 0 & \frac{1}{\sqrt{2}}(1+i) \end{bmatrix}$</td><td colspan="2">$\begin{bmatrix} 1 & 0 \\ 0 & e^{-\frac{i\pi}{4}} \end{bmatrix}$ or $\begin{bmatrix} 1 & 0 \\ 0 & \frac{1}{\sqrt{2}}(1-i) \end{bmatrix}$</td><td colspan="2">$\begin{bmatrix} 1 & 0 \\ 0 & e^{i\phi} \end{bmatrix}$</td></tr>
<tr><td>S|0>=|0></td><td>S|1> = i|1></td><td>S† |0>=|0></td><td>S† |1> = - i|1></td><td>T|0>=|0></td><td>T|1> = i|1></td><td>T† |0>=|0></td><td>T† |1> = - i|1></td><td>P|0>=|0></td><td>ϕ = π , P|1>= -1>
ϕ = π /2, P|1>= i|1>
ϕ = π /4, P|1>=. -i|1></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="2">ϕ = π , Z
ϕ = π /2, S
ϕ = π /4, T</td></tr>
</table>

<table>
<tr><th>Identity gate</th><th>Rotation Gates: Non-Clifford gates</th><th>Phase Gates</th><th>U</th></tr>
<tr><td rowspan="3">No operation, basis remain unchanged

I|0>=|0>
I|1>=|1>
Matrix representation:

$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$</td><td>Rotation through angle θ(radians) around the x-axis
$R_x(\theta) = \begin{pmatrix} \cos\left(\frac{\theta}{2}\right) & -i\sin\left(\frac{\theta}{2}\right) \\ -i\sin\left(\frac{\theta}{2}\right) & \cos\left(\frac{\theta}{2}\right) \end{pmatrix}$</td><td rowspan="3">Z

S

Sdg

T

Tdg

P</td><td rowspan="3">$\begin{bmatrix} \cos(\frac{\theta}{2}) & -e^{i\lambda}\sin(\frac{\theta}{2}) \\ e^{i\phi}\sin(\frac{\theta}{2}) & e^{i(\phi+\lambda)}\cos(\frac{\theta}{2}) \end{bmatrix}$
General form of a single unitary
Single qubit rotation with U(θ,ϕ,λ)
parametrised gate
most general of all single-qubit quantum gates
Superposition : u(pi/2,0,pi)
P gate using u(0,0,λ)</td></tr>
<tr><td>Rotation through angle θ(radians) around the y-axis
$R_y(\theta) = \begin{pmatrix} \cos\left(\frac{\theta}{2}\right) & -\sin\left(\frac{\theta}{2}\right) \\ \sin\left(\frac{\theta}{2}\right) & \cos\left(\frac{\theta}{2}\right) \end{pmatrix}$</td></tr>
<tr><td>Rotation through angle θ(radians) around the z-axis
$R_z(\theta) = \begin{pmatrix} e^{-i\frac{\theta}{2}} & 0 \\ 0 & e^{i\frac{\theta}{2}} \end{pmatrix}$</td></tr>
</table>