lab4

July 25, 2025

```
[1]: pip install "qc-grader[qiskit,jupyter] @ git+https://github.com/
     ↪qiskit-community/Quantum-Challenge-Grader.git"
```

Collecting qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git (from qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git)
  Cloning https://github.com/qiskit-community/Quantum-Challenge-Grader.git to
/tmp/pip-install-0d3l9t9e/qc-grader_096ab3188b7e486288341b925ffb3b09
  Running command git clone --filter=blob:none --quiet
https://github.com/qiskit-community/Quantum-Challenge-Grader.git /tmp/pip-
install-0d3l9t9e/qc-grader_096ab3188b7e486288341b925ffb3b09
  Resolved https://github.com/qiskit-community/Quantum-Challenge-Grader.git to
commit 1d7a6915623b0cfeac4c114391c279e9d98eb7f9
  Preparing metadata (setup.py) … done
Requirement already satisfied: typeguard in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (4.4.4)
Requirement already satisfied: jsonpickle==3.0.3 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (3.0.3)
Requirement already satisfied: requests==2.32.3 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (2.32.3)
Requirement already satisfied: ipycytoscape in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (1.3.3)
Requirement already satisfied: plotly in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-

community/Quantum-Challenge-Grader.git) (6.2.0)
Requirement already satisfied: networkx==3.2.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (3.2.1)
Requirement already satisfied: graphviz in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (0.21)
Requirement already satisfied: ibm-platform-services==0.66.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (0.66.1)
Requirement already satisfied: jupyterlab in /opt/conda/lib/python3.11/site-
packages (from qc-grader@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (4.2.0)
Requirement already satisfied: ipykernel in /opt/conda/lib/python3.11/site-
packages (from qc-grader@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (6.29.3)
Requirement already satisfied: qiskit~=2.1.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (2.1.1)
Requirement already satisfied: qiskit-ibm-runtime in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (0.40.1)
Requirement already satisfied: qiskit-aer in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (0.17.1)
Requirement already satisfied: qiskit_serverless in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (0.25.1)
Requirement already satisfied: ibm_cloud_sdk_core<4.0.0,>=3.24.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ibm-platform-services==0.66.1->qc-grader@ git+https://github.com/qiskit-

community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (3.24.1)
Requirement already satisfied: charset-normalizer<4,>=2 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
requests==2.32.3->qc-grader@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (3.4.2)
Requirement already satisfied: idna<4,>=2.5 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
requests==2.32.3->qc-grader@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
requests==2.32.3->qc-grader@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (2.5.0)
Requirement already satisfied: certifi>=2017.4.17 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
requests==2.32.3->qc-grader@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (2024.7.4)
Requirement already satisfied: python_dateutil<3.0.0,>=2.8.2 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ibm_cloud_sdk_core<4.0.0,>=3.24.1->ibm-platform-services==0.66.1->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (2.9.0.post0)
Requirement already satisfied: PyJWT<3.0.0,>=2.8.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ibm_cloud_sdk_core<4.0.0,>=3.24.1->ibm-platform-services==0.66.1->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (2.10.1)
Requirement already satisfied: six>=1.5 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
python_dateutil<3.0.0,>=2.8.2->ibm_cloud_sdk_core<4.0.0,>=3.24.1->ibm-platform-
services==0.66.1->qc-grader@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (1.17.0)
Requirement already satisfied: rustworkx>=0.15.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit~=2.1.0->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (0.16.0)
Requirement already satisfied: numpy<3,>=1.17 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from

qiskit~=2.1.0->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (2.3.1)
Requirement already satisfied: scipy>=1.5 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit~=2.1.0->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.16.0)
Requirement already satisfied: dill>=0.3 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit~=2.1.0->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (0.4.0)
Requirement already satisfied: stevedore>=3.0.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit~=2.1.0->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (5.4.1)
Requirement already satisfied: typing-extensions in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit~=2.1.0->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (4.14.1)
Requirement already satisfied: matplotlib>=3.3 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (3.10.3)
Requirement already satisfied: pydot in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (4.0.1)
Requirement already satisfied: Pillow>=4.2.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (11.3.0)
Requirement already satisfied: pylatexenc>=1.4 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from

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qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (2.10)
Requirement already satisfied: seaborn>=0.9.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (0.13.2)
Requirement already satisfied: sympy>=1.3 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.14.0)
Requirement already satisfied: contourpy>=1.0.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
matplotlib>=3.3->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.3.2)
Requirement already satisfied: cycler>=0.10 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
matplotlib>=3.3->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
matplotlib>=3.3->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (4.59.0)
Requirement already satisfied: kiwisolver>=1.3.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
matplotlib>=3.3->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.4.8)
Requirement already satisfied: packaging>=20.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
matplotlib>=3.3->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (25.0)
Requirement already satisfied: pyparsing>=2.3.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
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matplotlib>=3.3->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (3.2.3)
Requirement already satisfied: pandas>=1.2 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
seaborn>=0.9.0->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (2.3.1)
Requirement already satisfied: pytz>=2020.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
pandas>=1.2->seaborn>=0.9.0->qiskit[visualization]~=2.1.0; extra ==
"qiskit"->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (2025.2)
Requirement already satisfied: tzdata>=2022.7 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
pandas>=1.2->seaborn>=0.9.0->qiskit[visualization]~=2.1.0; extra ==
"qiskit"->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (2025.2)
Requirement already satisfied: pbr>=2.0.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
stevedore>=3.0.0->qiskit~=2.1.0->qiskit[visualization]~=2.1.0; extra ==
"qiskit"->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (6.1.1)
Requirement already satisfied: setuptools in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
pbr>=2.0.0->stevedore>=3.0.0->qiskit~=2.1.0->qiskit[visualization]~=2.1.0; extra
== "qiskit"->qc-grader@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (65.5.0)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
sympy>=1.3->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.3.0)
Requirement already satisfied: ipywidgets>=7.6.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (8.1.7)
Requirement already satisfied: spectate>=1.0.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-
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Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.0.1)
Requirement already satisfied: comm>=0.1.3 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.2.2)
Requirement already satisfied: ipython>=6.1.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (8.37.0)
Requirement already satisfied: traitlets>=4.3.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (5.14.3)
Requirement already satisfied: widgetsnbextension~=4.0.14 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (4.0.14)
Requirement already satisfied: jupyterlab_widgets~=3.0.15 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (3.0.15)
Requirement already satisfied: decorator in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (5.2.1)
Requirement already satisfied: jedi>=0.16 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.19.2)
Requirement already satisfied: matplotlib-inline in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.1.7)
Requirement already satisfied: pexpect>4.3 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@

git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (4.9.0)
Requirement already satisfied: prompt_toolkit<3.1.0,>=3.0.41 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (3.0.51)
Requirement already satisfied: pygments>=2.4.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.19.2)
Requirement already satisfied: stack_data in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.6.3)
Requirement already satisfied: wcwidth in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from prompt_toolkit<3.1.0,>=3.0.41->ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.2.13)
Requirement already satisfied: parso<0.9.0,>=0.8.4 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jedi>=0.16->ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.8.4)
Requirement already satisfied: ptyprocess>=0.5 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from pexpect>4.3->ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.7.0)
Requirement already satisfied: debugpy>=1.6.5 in /opt/conda/lib/python3.11/site-packages (from ipykernel->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.8.1)
Requirement already satisfied: jupyter-client>=6.1.12 in /opt/conda/lib/python3.11/site-packages (from ipykernel->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (8.6.1)

Requirement already satisfied: jupyter-core!=5.0.*,>=4.12 in /opt/conda/lib/python3.11/site-packages (from ipykernel->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (5.7.2)
Requirement already satisfied: nest-asyncio in /opt/conda/lib/python3.11/site-packages (from ipykernel->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.6.0)
Requirement already satisfied: psutil in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ipykernel->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (7.0.0)
Requirement already satisfied: pyzmq>=24 in /opt/conda/lib/python3.11/site-packages (from ipykernel->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (26.0.3)
Requirement already satisfied: tornado>=6.1 in /opt/conda/lib/python3.11/site-packages (from ipykernel->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (6.4)
Requirement already satisfied: platformdirs>=2.5 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jupyter-core!=5.0.*,>=4.12->ipykernel->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (4.3.8)
Requirement already satisfied: async-lru>=1.0.0 in /opt/conda/lib/python3.11/site-packages (from jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.0.4)
Requirement already satisfied: httpx>=0.25.0 in /opt/conda/lib/python3.11/site-packages (from jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.27.0)
Requirement already satisfied: jinja2>=3.0.3 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (3.1.6)
Requirement already satisfied: jupyter-lsp>=2.0.0 in /opt/conda/lib/python3.11/site-packages (from jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.2.5)
Requirement already satisfied: jupyter-server<3,>=2.4.0 in /opt/conda/lib/python3.11/site-packages (from jupyterlab->qc-grader@

git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.14.0)
Requirement already satisfied: jupyterlab-server<3,>=2.27.1 in /opt/conda/lib/python3.11/site-packages (from jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.27.1)
Requirement already satisfied: notebook-shim>=0.2 in /opt/conda/lib/python3.11/site-packages (from jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.2.4)
Requirement already satisfied: anyio>=3.1.0 in /opt/conda/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (4.3.0)
Requirement already satisfied: argon2-cffi>=21.1 in /opt/conda/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (23.1.0)
Requirement already satisfied: jupyter-events>=0.9.0 in /opt/conda/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.10.0)
Requirement already satisfied: jupyter-server-terminals>=0.4.4 in /opt/conda/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.5.3)
Requirement already satisfied: nbconvert>=6.4.4 in /opt/conda/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (7.16.4)
Requirement already satisfied: nbformat>=5.3.0 in /opt/conda/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (5.10.4)
Requirement already satisfied: overrides>=5.0 in /opt/conda/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (7.7.0)

Requirement already satisfied: prometheus-client>=0.9 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.22.1)
Requirement already satisfied: send2trash>=1.8.2 in /opt/conda/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.8.3)
Requirement already satisfied: terminado>=0.8.3 in /opt/conda/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.18.1)
Requirement already satisfied: websocket-client>=1.7 in /opt/conda/lib/python3.11/site-packages (from jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.8.0)
Requirement already satisfied: babel>=2.10 in /opt/conda/lib/python3.11/site-packages (from jupyterlab-server<3,>=2.27.1->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.14.0)
Requirement already satisfied: json5>=0.9.0 in /opt/conda/lib/python3.11/site-packages (from jupyterlab-server<3,>=2.27.1->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.9.25)
Requirement already satisfied: jsonschema>=4.18.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jupyterlab-server<3,>=2.27.1->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (4.25.0)
Requirement already satisfied: sniffio>=1.1 in /opt/conda/lib/python3.11/site-packages (from anyio>=3.1.0->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.3.1)
Requirement already satisfied: argon2-cffi-bindings in /opt/conda/lib/python3.11/site-packages (from argon2-cffi>=21.1->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (21.2.0)
Requirement already satisfied: httpcore==1.* in /opt/conda/lib/python3.11/site-packages (from httpx>=0.25.0->jupyterlab->qc-grader@

git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.0.5)
Requirement already satisfied: h11<0.15,>=0.13 in /opt/conda/lib/python3.11/site-packages (from httpcore==1.*->httpx>=0.25.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.14.0)
Requirement already satisfied: MarkupSafe>=2.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jinja2>=3.0.3->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (3.0.2)
Requirement already satisfied: attrs>=22.2.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jsonschema>=4.18.0->jupyterlab-server<3,>=2.27.1->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (25.3.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jsonschema>=4.18.0->jupyterlab-server<3,>=2.27.1->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2025.4.1)
Requirement already satisfied: referencing>=0.28.4 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jsonschema>=4.18.0->jupyterlab-server<3,>=2.27.1->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.36.2)
Requirement already satisfied: rpds-py>=0.7.1 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jsonschema>=4.18.0->jupyterlab-server<3,>=2.27.1->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.26.0)
Requirement already satisfied: python-json-logger>=2.0.4 in /opt/conda/lib/python3.11/site-packages (from jupyter-events>=0.9.0->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.0.7)
Requirement already satisfied: pyyaml>=5.3 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from jupyter-events>=0.9.0->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-

Challenge-Grader.git) (6.0.2)
Requirement already satisfied: rfc3339-validator in
/opt/conda/lib/python3.11/site-packages (from jupyter-events>=0.9.0->jupyter-
server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.1.4)
Requirement already satisfied: rfc3986-validator>=0.1.1 in
/opt/conda/lib/python3.11/site-packages (from jupyter-events>=0.9.0->jupyter-
server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.1.1)
Requirement already satisfied: fqdn in /opt/conda/lib/python3.11/site-packages
(from jsonschema[format-nongpl]>=4.18.0->jupyter-events>=0.9.0->jupyter-
server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.5.1)
Requirement already satisfied: isoduration in /opt/conda/lib/python3.11/site-
packages (from jsonschema[format-nongpl]>=4.18.0->jupyter-
events>=0.9.0->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (20.11.0)
Requirement already satisfied: jsonpointer>1.13 in
/opt/conda/lib/python3.11/site-packages (from jsonschema[format-
nongpl]>=4.18.0->jupyter-events>=0.9.0->jupyter-
server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.4)
Requirement already satisfied: rfc3987-syntax>=1.1.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
jsonschema[format-nongpl]>=4.18.0->jupyter-events>=0.9.0->jupyter-
server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.1.0)
Requirement already satisfied: uri-template in /opt/conda/lib/python3.11/site-
packages (from jsonschema[format-nongpl]>=4.18.0->jupyter-
events>=0.9.0->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.3.0)
Requirement already satisfied: webcolors>=24.6.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
jsonschema[format-nongpl]>=4.18.0->jupyter-events>=0.9.0->jupyter-
server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (24.11.1)
Requirement already satisfied: beautifulsoup4 in /opt/conda/lib/python3.11/site-
packages (from nbconvert>=6.4.4->jupyter-server<3,>=2.4.0->jupyterlab->qc-

grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (4.12.3)
Requirement already satisfied: bleach!=5.0.0 in /opt/conda/lib/python3.11/site-packages (from nbconvert>=6.4.4->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (6.1.0)
Requirement already satisfied: defusedxml in /opt/conda/lib/python3.11/site-packages (from nbconvert>=6.4.4->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.7.1)
Requirement already satisfied: jupyterlab-pygments in /opt/conda/lib/python3.11/site-packages (from nbconvert>=6.4.4->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.3.0)
Requirement already satisfied: mistune<4,>=2.0.3 in /opt/conda/lib/python3.11/site-packages (from nbconvert>=6.4.4->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (3.0.2)
Requirement already satisfied: nbclient>=0.5.0 in /opt/conda/lib/python3.11/site-packages (from nbconvert>=6.4.4->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.10.0)
Requirement already satisfied: pandocfilters>=1.4.1 in /opt/conda/lib/python3.11/site-packages (from nbconvert>=6.4.4->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.5.0)
Requirement already satisfied: tinycss2 in /opt/conda/lib/python3.11/site-packages (from nbconvert>=6.4.4->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.3.0)
Requirement already satisfied: webencodings in /opt/conda/lib/python3.11/site-packages (from bleach!=5.0.0->nbconvert>=6.4.4->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.5.1)
Requirement already satisfied: fastjsonschema>=2.15 in /opt/conda/lib/python3.11/site-packages (from nbformat>=5.3.0->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.19.1)

Requirement already satisfied: lark>=1.2.2 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
rfc3987-syntax>=1.1.0->jsonschema[format-nongpl]>=4.18.0->jupyter-
events>=0.9.0->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.2.2)
Requirement already satisfied: cffi>=1.0.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
argon2-cffi-bindings->argon2-cffi>=21.1->jupyter-
server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.17.1)
Requirement already satisfied: pycparser in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
cffi>=1.0.1->argon2-cffi-bindings->argon2-cffi>=21.1->jupyter-
server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.22)
Requirement already satisfied: soupsieve>1.2 in /opt/conda/lib/python3.11/site-
packages (from beautifulsoup4->nbconvert>=6.4.4->jupyter-
server<3,>=2.4.0->jupyterlab->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.5)
Requirement already satisfied: arrow>=0.15.0 in /opt/conda/lib/python3.11/site-
packages (from isoduration->jsonschema[format-nongpl]>=4.18.0->jupyter-
events>=0.9.0->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.3.0)
Requirement already satisfied: types-python-dateutil>=2.8.10 in
/opt/conda/lib/python3.11/site-packages (from
arrow>=0.15.0->isoduration->jsonschema[format-nongpl]>=4.18.0->jupyter-
events>=0.9.0->jupyter-server<3,>=2.4.0->jupyterlab->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (2.9.0.20240316)
Requirement already satisfied: narwhals>=1.15.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
plotly->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (1.47.1)
Requirement already satisfied: requests-ntlm>=1.1.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit-ibm-runtime->qc-grader@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (1.3.0)
Requirement already satisfied: pydantic>=2.5.0 in

/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit-ibm-runtime->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.11.7)
Requirement already satisfied: annotated-types>=0.6.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from pydantic>=2.5.0->qiskit-ibm-runtime->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.7.0)
Requirement already satisfied: pydantic-core==2.33.2 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from pydantic>=2.5.0->qiskit-ibm-runtime->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.33.2)
Requirement already satisfied: typing-inspection>=0.4.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from pydantic>=2.5.0->qiskit-ibm-runtime->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.4.1)
Requirement already satisfied: cryptography>=1.3 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from requests-ntlm>=1.1.0->qiskit-ibm-runtime->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (45.0.5)
Requirement already satisfied: pyspnego>=0.4.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from requests-ntlm>=1.1.0->qiskit-ibm-runtime->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.11.2)
Requirement already satisfied: ray<3,>=2.30 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.47.1)
Requirement already satisfied: importlib-metadata<9,>=5.2.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (8.4.0)
Requirement already satisfied: cloudpickle==2.2.1 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.2.1)
Requirement already satisfied: tqdm<5,>=4.66.3 in

/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (4.67.1)
Requirement already satisfied: opentelemetry-api<1.33.1,>=1.18.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.33.0)
Requirement already satisfied: opentelemetry-sdk<1.33.1,>=1.18.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.33.0)
Requirement already satisfied: opentelemetry-exporter-otlp-proto-grpc<1.33.1,>=1.18.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.33.0)
Requirement already satisfied: s3fs>=2023.6.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2025.7.0)
Requirement already satisfied: opentelemetry-instrumentation-requests>=0.40b0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.54b0)
Requirement already satisfied: pyarrow<19,>=16.0.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (18.1.0)
Requirement already satisfied: aiohttp<4,>=3.10.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (3.12.14)
Requirement already satisfied: zipp==3.19.1 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (3.19.1)
Requirement already satisfied: aiohappyeyeballs>=2.5.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from aiohttp<4,>=3.10.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-

17

community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.6.1)
Requirement already satisfied: aiosignal>=1.4.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
aiohttp<4,>=3.10.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.4.0)
Requirement already satisfied: frozenlist>=1.1.1 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
aiohttp<4,>=3.10.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.7.0)
Requirement already satisfied: multidict<7.0,>=4.5 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
aiohttp<4,>=3.10.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (6.6.3)
Requirement already satisfied: propcache>=0.2.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
aiohttp<4,>=3.10.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.3.2)
Requirement already satisfied: yarl<2.0,>=1.17.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
aiohttp<4,>=3.10.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.20.1)
Requirement already satisfied: deprecated>=1.2.6 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
opentelemetry-api<1.33.1,>=1.18.0->qiskit_serverless->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.2.18)
Requirement already satisfied: googleapis-common-protos~=1.52 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
opentelemetry-exporter-otlp-proto-grpc<1.33.1,>=1.18.0->qiskit_serverless->qc-
grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (1.70.0)
Requirement already satisfied: grpcio<2.0.0,>=1.63.2 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
opentelemetry-exporter-otlp-proto-grpc<1.33.1,>=1.18.0->qiskit_serverless->qc-
grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (1.73.1)
Requirement already satisfied: opentelemetry-exporter-otlp-proto-common==1.33.0
in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages
(from opentelemetry-exporter-otlp-proto-

grpc<1.33.1,>=1.18.0->qiskit_serverless->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.33.0)
Requirement already satisfied: opentelemetry-proto==1.33.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
opentelemetry-exporter-otlp-proto-grpc<1.33.1,>=1.18.0->qiskit_serverless->qc-
grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (1.33.0)
Requirement already satisfied: protobuf<6.0,>=5.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
opentelemetry-proto==1.33.0->opentelemetry-exporter-otlp-proto-
grpc<1.33.1,>=1.18.0->qiskit_serverless->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (5.29.5)
Requirement already satisfied: opentelemetry-semantic-conventions==0.54b0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
opentelemetry-sdk<1.33.1,>=1.18.0->qiskit_serverless->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (0.54b0)
Requirement already satisfied: symengine<0.14,>=0.11 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
qiskit~=2.1.0->qiskit[visualization]~=2.1.0; extra == "qiskit"->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (0.13.0)
Requirement already satisfied: click>=7.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ray<3,>=2.30->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (8.2.1)
Requirement already satisfied: filelock in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ray<3,>=2.30->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (3.18.0)
Requirement already satisfied: msgpack<2.0.0,>=1.0.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
ray<3,>=2.30->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (1.1.1)
Requirement already satisfied: aiohttp_cors in

/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.8.1)
Requirement already satisfied: colorful in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.5.7)
Requirement already satisfied: py-spy>=0.2.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.4.0)
Requirement already satisfied: opencensus in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.11.4)
Requirement already satisfied: opentelemetry-exporter-prometheus in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.54b0)
Requirement already satisfied: smart_open in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (7.3.0.post1)
Requirement already satisfied: virtualenv!=20.21.1,>=20.0.24 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (20.31.2)
Requirement already satisfied: wrapt<2,>=1.10 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from deprecated>=1.2.6->opentelemetry-api<1.33.1,>=1.18.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.17.2)
Requirement already satisfied: opentelemetry-instrumentation==0.54b0 in

/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from opentelemetry-instrumentation-requests>=0.40b0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.54b0)
Requirement already satisfied: opentelemetry-util-http==0.54b0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from opentelemetry-instrumentation-requests>=0.40b0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.54b0)
Requirement already satisfied: aiobotocore<3.0.0,>=2.5.4 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from s3fs>=2023.6.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.23.1)
Requirement already satisfied: fsspec==2025.7.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from s3fs>=2023.6.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2025.7.0)
Requirement already satisfied: aioitertools<1.0.0,>=0.5.1 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from aiobotocore<3.0.0,>=2.5.4->s3fs>=2023.6.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.12.0)
Requirement already satisfied: botocore<1.38.47,>=1.38.40 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from aiobotocore<3.0.0,>=2.5.4->s3fs>=2023.6.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.38.46)
Requirement already satisfied: jmespath<2.0.0,>=0.7.1 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from aiobotocore<3.0.0,>=2.5.4->s3fs>=2023.6.0->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.0.1)
Requirement already satisfied: distlib<1,>=0.3.7 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from virtualenv!=20.21.1,>=20.0.24->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.4.0)
Requirement already satisfied: opencensus-context>=0.1.3 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from opencensus->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@

git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.1.3)
Requirement already satisfied: google-api-core<3.0.0,>=1.0.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from opencensus->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.25.1)
Requirement already satisfied: proto-plus<2.0.0,>=1.22.3 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from google-api-core<3.0.0,>=1.0.0->opencensus->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (1.26.1)
Requirement already satisfied: google-auth<3.0.0,>=2.14.1 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from google-api-core<3.0.0,>=1.0.0->opencensus->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (2.40.3)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from google-auth<3.0.0,>=2.14.1->google-api-core<3.0.0,>=1.0.0->opencensus->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (5.5.2)
Requirement already satisfied: pyasn1-modules>=0.2.1 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from google-auth<3.0.0,>=2.14.1->google-api-core<3.0.0,>=1.0.0->opencensus->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (0.4.2)
Requirement already satisfied: rsa<5,>=3.1.4 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from google-auth<3.0.0,>=2.14.1->google-api-core<3.0.0,>=1.0.0->opencensus->ray[default]<3,>=2.30->qiskit_serverless->qc-grader@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git) (4.9.1)
Requirement already satisfied: pyasn1>=0.1.3 in /opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from rsa<5,>=3.1.4->google-auth<3.0.0,>=2.14.1->google-api-core<3.0.0,>=1.0.0->opencensus->ray[default]<3,>=2.30->qiskit_serverless->qc-

grader@ git+https://github.com/qiskit-community/Quantum-Challenge-
Grader.git->qc-grader[jupyter,qiskit]@ git+https://github.com/qiskit-
community/Quantum-Challenge-Grader.git) (0.6.1)
Requirement already satisfied: executing>=1.2.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
stack_data->ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (2.2.0)
Requirement already satisfied: asttokens>=2.1.0 in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
stack_data->ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (3.0.0)
Requirement already satisfied: pure-eval in
/opt/.qbraid/environments/qgss_000000/pyenv/lib/python3.11/site-packages (from
stack_data->ipython>=6.1.0->ipywidgets>=7.6.0->ipycytoscape->qc-grader@
git+https://github.com/qiskit-community/Quantum-Challenge-Grader.git->qc-
grader[jupyter,qiskit]@ git+https://github.com/qiskit-community/Quantum-
Challenge-Grader.git) (0.2.3)
Note: you may need to restart the kernel to use updated packages.

```python
[2]: import qiskit
import qc_grader
print(f"Qiskit version: {qiskit.__version__}")
print(f"Grader version: {qc_grader.__version__}")
```

Qiskit version: 2.1.1
Grader version: 0.22.12

```python
[3]: # Check that the account has been saved properly
from qiskit_ibm_runtime import QiskitRuntimeService

service = QiskitRuntimeService(name="qgss-2025")
service.saved_accounts()
```

[3]: {'qgss-2025': {'channel': 'ibm_quantum_platform',
    'url': 'https://cloud.ibm.com',
    'token': 'xi0nZf18SfBZn-P1f124QEWDywbHVDPldD9sjHLkYjNE',
    'instance': 'crn:v1:bluemix:public:quantum-computing:us-
east:a/28121048c51949f9a93006ccbc7b3faf:edce2be1-5f4f-4532-9d3d-72a7b8c6538d::',
    'verify': True,
    'private_endpoint': False}}

```python
[4]: # Import common packages first
import numpy as np
```

```python
# Import qiskit classes
from qiskit import QuantumCircuit, QuantumRegister, ClassicalRegister
from qiskit.transpiler.preset_passmanagers import generate_preset_pass_manager
from qiskit.visualization import plot_histogram

# Import utils and cosystems
from lab4_util import hamming_distance, minimum_distance, bring_states,
    matrixRank
from qiskit_aer import AerSimulator
from qiskit_ibm_runtime import SamplerV2  as Sampler

# Import grader
from qc_grader.challenges.qgss_2025 import (
    grade_lab4_ex1,
    grade_lab4_ex2,
    grade_lab4_ex3,
    grade_lab4_ex4,
    grade_lab4_ex5,
    grade_lab4_ex6
)
```

```python
[5]: # Example usage:
str1 = "10110"
str2 = "11100"
dist = hamming_distance(str1, str2)
print(f"Hamming distance between '{str1}' and '{str2}' is: {dist}") # Output: 2

vec1 = [1, 0, 0, 1]
vec2 = [0, 0, 1, 1]
dist_vec = hamming_distance(vec1, vec2)
print(f"Hamming distance between {vec1} and {vec2} is: {dist_vec}") # Output: 2
```

```
Hamming distance between '10110' and '11100' is: 2
Hamming distance between [1, 0, 0, 1] and [0, 0, 1, 1] is: 2
```

```python
[6]: # --- Example: A Simple [4, 3, 2] Parity Check Code ---
# This code takes 3 message bits (k=3) and adds an even parity bit
# to make the total codeword length n=4.
# Messages: 000, 001, 010, 011, 100, 101, 110, 111
# Codewords (adding even parity bit):
parity_code_4_3 = [
    "0000", # 000 + 0 (even parity)
    "0011", # 001 + 1
    "0101", # 010 + 1
    "0110", # 011 + 0
    "1001", # 100 + 1
```

```python
    "1010", # 101 + 0
    "1100", # 110 + 0
    "1111"  # 111 + 1
]

# Calculate the minimum distance d
d_parity = minimum_distance(parity_code_4_3)
print(f"Codewords: {parity_code_4_3}")
print(f"Calculated minimum distance d = {d_parity}") # Output: 2
```

```
Codewords: ['0000', '0011', '0101', '0110', '1001', '1010', '1100', '1111']
Calculated minimum distance d = 2
```

```python
[7]: # --- Example: [3, 1, 3] Repetition Code ---
     repetition_code_3_1 = ["000", "111"]
     d_repetition = minimum_distance(repetition_code_3_1)
     print(f"Calculated minimum distance d = {d_repetition}") # Output: 3

     # Capabilities for d=3:
     t_detect = d_repetition - 1
     t_correct = int((d_repetition - 1) / 2) // 1
     print(f"Error Detection Capability (t_detect = d-1): {t_detect}") # Output: 2
     print(f"Error Correction Capability (t_correct = floor((d-1)/2)): {t_correct}")↵
       ↪# Output: 1
```

```
Calculated minimum distance d = 3
Error Detection Capability (t_detect = d-1): 2
Error Correction Capability (t_correct = floor((d-1)/2)): 1
```

```python
[8]: test_str = "010"

     print("Hamming distance between 010 and 000 is", hamming_distance(test_str,↵
       ↪"000"))
     print("Hamming distance between 010 and 111 is", hamming_distance(test_str,↵
       ↪"111"))
```

```
Hamming distance between 010 and 000 is 1
Hamming distance between 010 and 111 is 2
```

```python
[9]: hardcode_decoder_3_1_3 = {
         '000': '0',  # No error
         '001': '0',  # Single-bit error corrected to 000
         '010': '0',  # Single-bit error corrected to 000
         '011': '1',  # Single-bit error corrected to 111
         '100': '0',  # Single-bit error corrected to 000
         '101': '1',  # Single-bit error corrected to 111
         '110': '1',  # Single-bit error corrected to 111
```

```
        '111': '1'    # No error
    }
```

```
[10]: test_str = "010"
      print("Hamming distance between 010 and 000 is", hamming_distance(test_str,␣
        ↪"000"))
      print("Hamming distance between 010 and 111 is", hamming_distance(test_str,␣
        ↪"111"))
      print("Decoded bit:", hardcode_decoder_3_1_3[test_str])
```

```
Hamming distance between 010 and 000 is 1
Hamming distance between 010 and 111 is 2
Decoded bit: 0
```

```
[11]: hardcode_decoder_bit_flip_syndrome_map = {
          '00': 'I',    # No error
          '01': 'X2',   # Error on qubit 2
          '10': 'X0',   # Error on qubit 0
          '11': 'X1'    # Error on qubit 1
      }
```

```
[12]: # Submit your answer using following code
      grade_lab4_ex1(hardcode_decoder_bit_flip_syndrome_map )
```

```
Submitting your answer. Please wait…
Congratulations!   Your answer is correct.
```

```
[13]: steane_decoder_syndrome_map = {
          # X errors
          '111000': 'X0',
          '011000': 'X1',
          '101000': 'X2',
          '001000': 'X3',
          '110000': 'X4',
          '010000': 'X5',
          '100000': 'X6',

          # Y errors
          '111111': 'Y0',
          '011011': 'Y1',
          '101101': 'Y2',
          '001001': 'Y3',
          '110110': 'Y4',
          '010010': 'Y5',
          '100100': 'Y6',

          # Z errors
```

```
        '000111': 'Z0',
        '000011': 'Z1',
        '000101': 'Z2',
        '000001': 'Z3',
        '000110': 'Z4',
        '000010': 'Z5',
        '000100': 'Z6',

        # No error
        '000000': 'I'
    }
```

[14]:
```
# Submit your answer using following code
grade_lab4_ex2(steane_decoder_syndrome_map)
```

Submitting your answer. Please wait…
Congratulations!   Your answer is correct.

[15]:
```
def measure_steane_syndrome(qc, q_data, q_anc, c_reg):
    # ---- X-type Stabilizers ----
    qc.h(q_data)  # Convert X basis to Z basis for measurement

    # S0: IIIXXXX (qubits 0,1,2,3)
    qc.cx(q_data[0], q_anc[0])
    qc.cx(q_data[1], q_anc[0])
    qc.cx(q_data[2], q_anc[0])
    qc.cx(q_data[3], q_anc[0])

    # S1: IXXIIXX (qubits 1,2,5,6)
    qc.cx(q_data[1], q_anc[1])
    qc.cx(q_data[2], q_anc[1])
    qc.cx(q_data[5], q_anc[1])
    qc.cx(q_data[6], q_anc[1])

    # S2: XIXIXIX (qubits 0,2,4,6)
    qc.cx(q_data[0], q_anc[2])
    qc.cx(q_data[2], q_anc[2])
    qc.cx(q_data[4], q_anc[2])
    qc.cx(q_data[6], q_anc[2])

    qc.h(q_data)   # Return qubits back to original basis
    qc.measure(q_anc[0:3], c_reg[0:3])
    qc.barrier()

    # ---- Z-type Stabilizers ----
    # S3: IIIZZZZ (qubits 0,1,2,3)
    qc.cx(q_data[0], q_anc[3])
```

```
        qc.cx(q_data[1], q_anc[3])
        qc.cx(q_data[2], q_anc[3])
        qc.cx(q_data[3], q_anc[3])

        # S4: IZZIIZZ (qubits 1,2,5,6)
        qc.cx(q_data[1], q_anc[4])
        qc.cx(q_data[2], q_anc[4])
        qc.cx(q_data[5], q_anc[4])
        qc.cx(q_data[6], q_anc[4])

        # S5: ZIZIZIZ (qubits 0,2,4,6)
        qc.cx(q_data[0], q_anc[5])
        qc.cx(q_data[2], q_anc[5])
        qc.cx(q_data[4], q_anc[5])
        qc.cx(q_data[6], q_anc[5])

        qc.measure(q_anc[3:6], c_reg[3:6])
        qc.barrier()
```

[16]:
```
state = bring_states()

# Logical qubit (7 data qubits)
qr_data = QuantumRegister(7, name='q')
# Ancilla qubits for syndrome measurement (6)
qr_anc = QuantumRegister(6, name='anc')
# Classical registers for syndrome (initial & verify)
cr_initial_syn = ClassicalRegister(6, name='c_initial_syn')
cr_final_syn = ClassicalRegister(6, name='c_final_syn')

# Total circuit (13 qubits, 12 classical bits)
qc = QuantumCircuit(qr_data, qr_anc, cr_initial_syn, cr_final_syn)

# ---- TODO : Task 3 ---
# initialize qc with the correct state
qc.initialize(state, qr_data)
# --- End of TODO ---
```

[16]: <qiskit.circuit.instructionset.InstructionSet at 0x7f41e907df60>

[17]:
```
# --- Add Syndrome Measurement ---
measure_steane_syndrome(qc, qr_data, qr_anc, cr_initial_syn)

qc.draw('mpl', fold=-1)
```
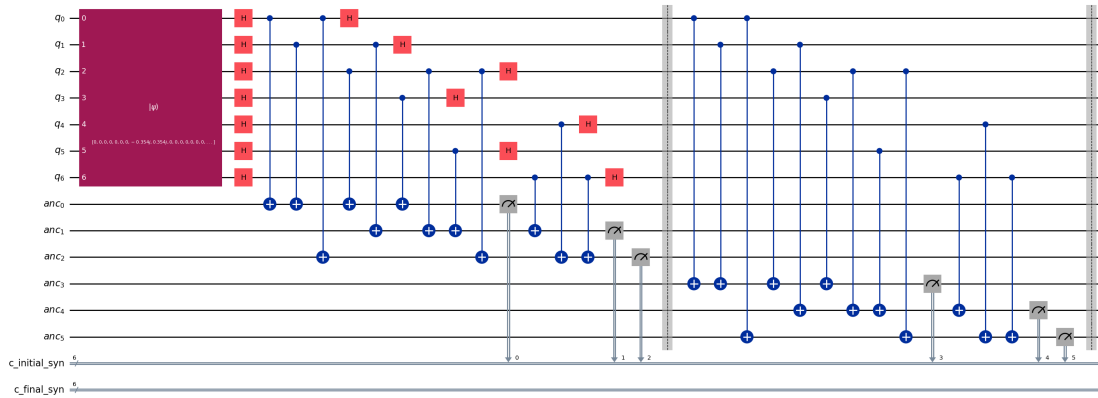
[17]:

28

```
[18]:  # --- Run the Simulation using AerSimulator
       backend = AerSimulator()

       # make quantum circuit compatible to the backend
       pm = generate_preset_pass_manager(backend=backend, optimization_level=3)
       qc_isa = pm.run(qc)

       # run and get counts
       sampler = Sampler(mode=backend)
       counts = sampler.run([qc_isa], shots=10000).result()[0].data.c_initial_syn.
         ↪get_counts()

       # ---- TODO : Task 3 ---
       # get key of simulation result and find the error code, ex: X1

       key = list(counts.keys())[0]   # Extract the 6-bit syndrome
       error_code = steane_decoder_syndrome_map[key]   # Lookup the error code

       # --- End of TODO ---
```
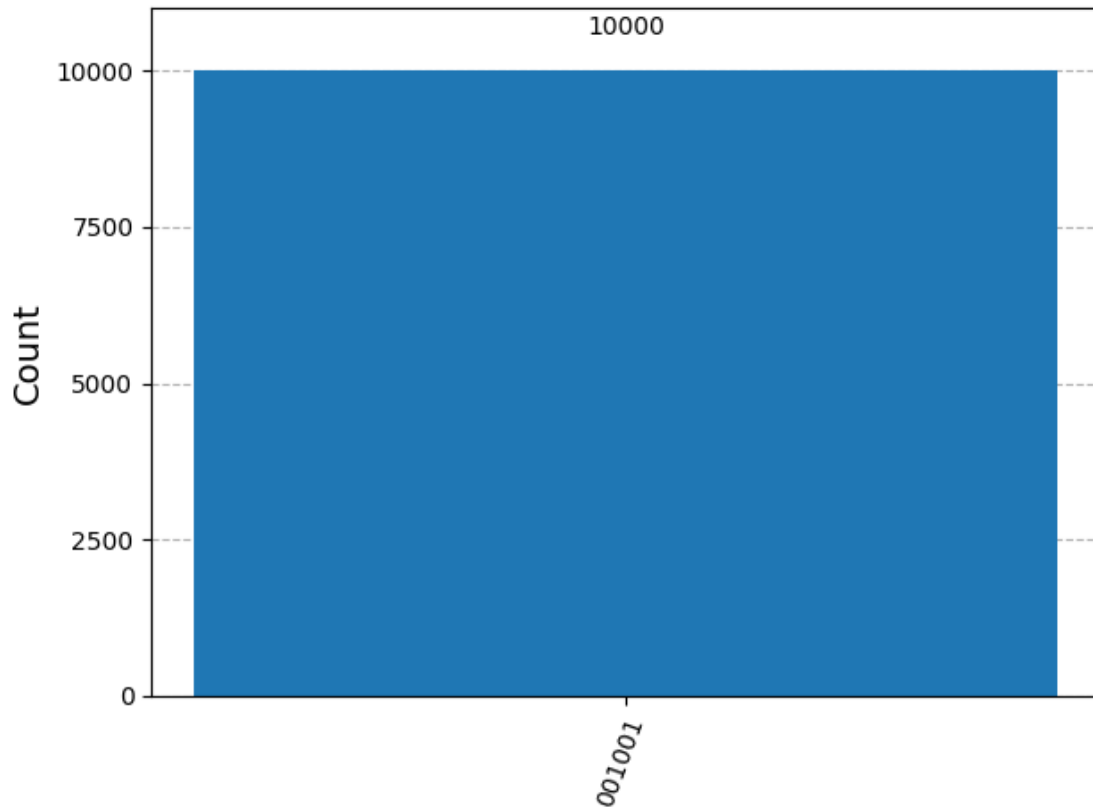
```
[19]:  plot_histogram(counts)
```

[19]:
```
```

```
[20]: # Submit your answer using following code
      grade_lab4_ex3(error_code)
```

Submitting your answer. Please wait…
Congratulations!   Your answer is correct.

```
[21]: qc = QuantumCircuit(qr_data, qr_anc, cr_initial_syn, cr_final_syn)

      # ---- TODO : ungraded task ---
      # initialize qr_data with State
      qc.initialize(state, qr_data)

      # correct error by applying proper gate based on detected error_code
      if error_code[0] == 'X':
          qc.x(qr_data[int(error_code[1])])
      elif error_code[0] == 'Y':
          qc.y(qr_data[int(error_code[1])])
      elif error_code[0] == 'Z':
          qc.z(qr_data[int(error_code[1])])
      # If error_code == 'I', do nothing
      # --- End of TODO ---
```
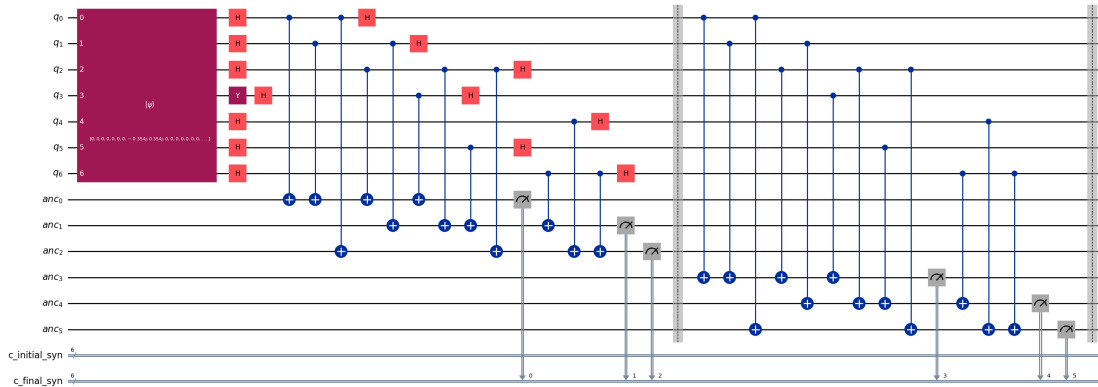
```
measure_steane_syndrome(qc, qr_data, qr_anc, cr_final_syn)

qc.draw('mpl', fold=-1)
```
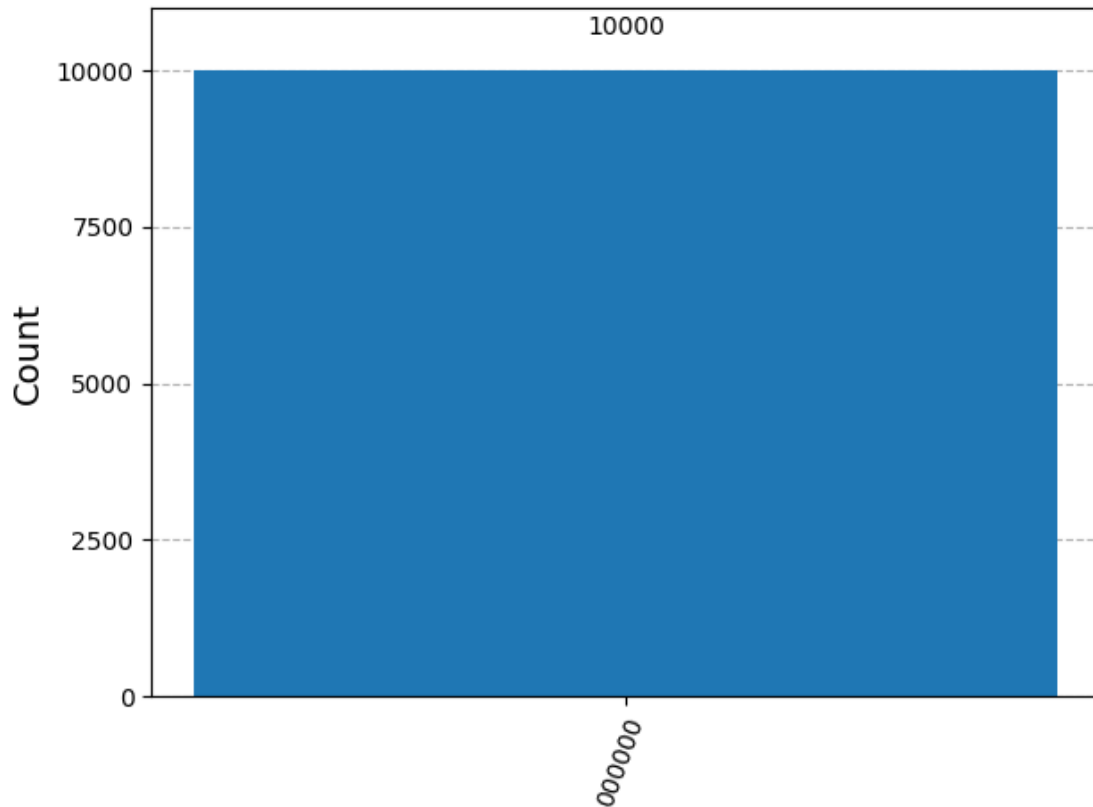
[21]:

[22]:
```
qc_isa = pm.run(qc)
counts = sampler.run([qc_isa], shots = 10000).result()[0].data.c_final_syn.
  ↪get_counts()

plot_histogram(counts)
```

[22]:

```
[23]:  # Initialize parity check matrices
       HXtc = np.zeros((72, 144), dtype=int)
       HZtc = np.zeros((72, 144), dtype=int)

       # Build HXtc using the toric code rules
       for j in range(72):
           HXtc[j][j] = 1
           HXtc[j][int(6*np.floor(j/6) + np.mod(j+1, 6))] = 1
           HXtc[j][72 + j] = 1
           HXtc[j][int(72 + 6 * np.mod(np.floor(j/6) - 1, 12) + np.mod(j, 6))] = 1

       # Build HZtc using the corrected rules
       for j in range(72):
           HZtc[j][j] = 1
           HZtc[j][int(6 * np.mod(np.floor(j/6) + 1, 12) + np.mod(j, 6))] = 1
           HZtc[j][72 + j] = 1
           HZtc[j][int(72 + 6 * np.floor(j/6) + np.mod(j - 1, 6))] = 1

       # Plot and grade
       from lab4_util import generate_stabilizer_plots
       generate_stabilizer_plots(HXtc, HZtc)
```
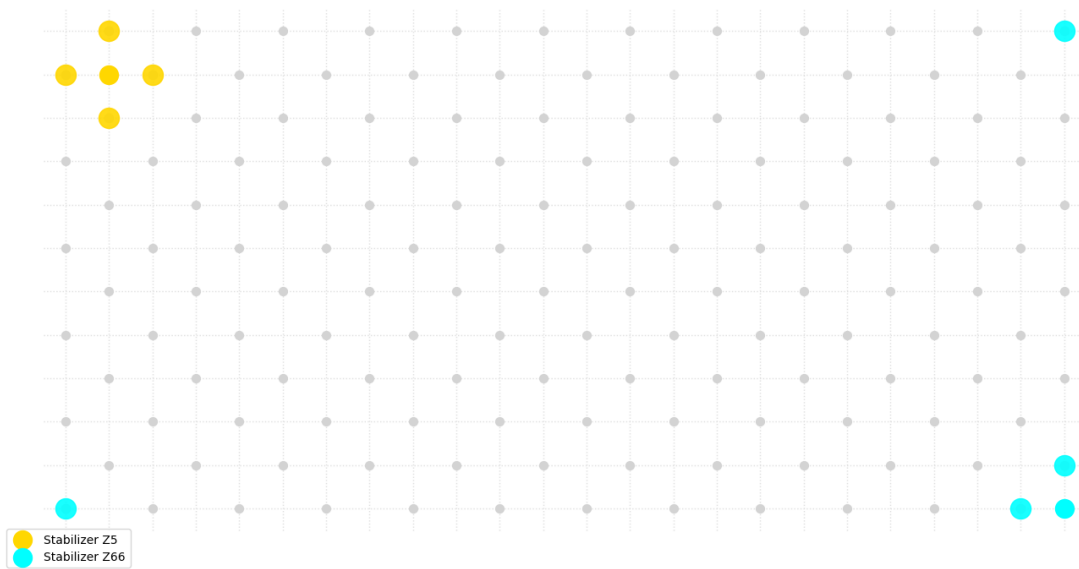
```
grade_lab4_ex4(HXtc, HZtc)
```

X-Stabilizer Check - 5, 66

Z-Stabilizer Check - 5, 66

Submitting your answer. Please wait…

Congratulations!   Your answer is correct.

```
[25]: HXgc = np.zeros((72, 144), dtype=int)
      HZgc = np.zeros((72, 144), dtype=int)

      for col in range(12):
          for row in range(6):
              idx_blue = col * 6 + row       # 0 to 71
              idx_orange = idx_blue + 72     # 72 to 143

              # --- HXgc ---
              HXgc[idx_blue][idx_blue] = 1  # itself
              HXgc[idx_blue][col * 6 + (row + 1) % 6] = 1  # right neighbor (blue)
              HXgc[idx_blue][((col + 3) % 12) * 6 + (row + 2) % 6] = 1  # diagonal
      →far blue
              HXgc[idx_blue][idx_orange] = 1  # own orange
              HXgc[idx_blue][((col - 2) % 12) * 6 + (row + 3) % 6 + 72] = 1  # orange
              HXgc[idx_blue][((col - 1) % 12) * 6 + row + 72] = 1  # orange neighbor

              # --- HZgc ---
              HZgc[idx_blue][idx_blue] = 1  # itself
              HZgc[idx_blue][col * 6 + (row - 1) % 6 + 72] = 1  # orange below
              HZgc[idx_blue][idx_orange] = 1  # own orange
              HZgc[idx_blue][((col + 1) % 12) * 6 + row] = 1  # right neighbor blue
              HZgc[idx_blue][int(6 * ((col + 2) % 12) + (row + 3) % 6)] = 1   #
      →diagonal far blue
              HZgc[idx_blue][int(72 + 6 * ((col - 3) % 12) + (row - 2) % 6)] = 1   #
      →far orange
                      # long-range diagonal bottom-right

      # Visualize and grade
      generate_stabilizer_plots(HXgc, HZgc)
      grade_lab4_ex5(HXgc, HZgc)




      # Optional: Visual check
      generate_stabilizer_plots(HXgc, HZgc)

      # Grade submission
      grade_lab4_ex5(HXgc, HZgc)
```

X-Stabilizer Check - 5, 66

Stabilizer X5
Stabilizer X66

Z-Stabilizer Check - 5, 66

Stabilizer Z5
Stabilizer Z66

```
Submitting your answer. Please wait…
Congratulations!   Your answer is correct.
```

X-Stabilizer Check - 5, 66

Stabilizer X5
Stabilizer X66

Z-Stabilizer Check - 5, 66

Stabilizer Z5
Stabilizer Z66

Submitting your answer. Please wait…
Congratulations!   Your answer is correct.

```python
[26]: from lab4_util import matrixRank

      # Total number of physical qubits
      n = 144

      # --- Toric Code ---
      rx_toric = matrixRank(HXtc)
      rz_toric = matrixRank(HZtc)
      k_toric = n - rx_toric - rz_toric

      # --- Gross Code ---
      rx_gross = matrixRank(HXgc)
      rz_gross = matrixRank(HZgc)
      k_gross = n - rx_gross - rz_gross

      # Submit your answer
      grade_lab4_ex6(k_toric, k_gross)
```

```
Submitting your answer. Please wait…
Congratulations!   Your answer is correct.
```

```python
[27]: # Check your submission status with the code below
      from qc_grader.grader.grade import check_lab_completion_status

      check_lab_completion_status("qgss_2025")
```

```
Lab 0: 2/2 exercises completed (100%)
      2573 participants have completed this lab
Lab 1: 9/9 exercises completed (100%)
      2227 participants have completed this lab
Lab 2: 7/7 exercises completed (100%)
      1508 participants have completed this lab
Lab 3: 5/5 exercises completed (100%)
      1391 participants have completed this lab
Lab 4: 6/6 exercises completed (100%)
      1365 participants have completed this lab
Functions Labs: 0/8 exercises completed (0%)
      6 participants have completed this lab
```

```python
[ ]:
```