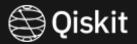
Qiskit 개발자 자격 시험

Inho Choi

Qiskit Advocate

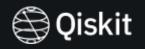


구성

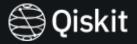


- Lecture 1: 게이트와 양자 회로
- Lecture 2: 양자 회로의 측정과 OpenQasm
- Lecture 3: 양자 백엔드에 양자회로 실행하기
- Lecture 4: 양자 회로 및 회로의 정보와 실행결과를 해석하기
- Lecture 5: 유용한 기능들

Lecture 5: 유용한 기능들

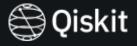


- 1. IBMQ 백엔드 필터
- 2. Qiskit 도구



IBMQ 백엔드필터

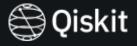
접근 가능한 백엔드 출력



```
ibmq_account = IBMQ.load_account()
backends = ibmq_account.backends()
backends
```

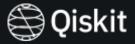
```
[<IBMQSimulator('ibmq_qasm_simulator') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_lima') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_belem') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_quito') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_statevector') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_mps') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_extended_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_manila') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibm_nairobi') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibm_oslo') from IBMQ(hub='ibm-q', group='open', project='main')>]
```

접근 가능한 백엔드 출력



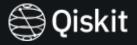
```
ibmq_account = IBMQ.load_account()
backends = ibmq_account.backends()
backends
filter option
```

```
[<IBMQSimulator('ibmq_qasm_simulator') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_lima') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_belem') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_quito') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_statevector') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_mps') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_extended_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_manila') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibm_nairobi') from IBMQ(hub='ibm-q', group='open', project='main')>]
```



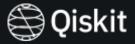
```
bmq_account.backends(filters=lambda b: b.configuration().n_qubits > 5)
```

```
[<IBMQSimulator('ibmq_qasm_simulator') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_statevector') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_mps') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_extended_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibm_nairobi') from IBMQ(hub='ibm-q', group='open', project='main')>]
```

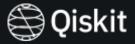


```
ibmq_account.backends(filters=lambda b: b.configuration().n_qubits > 5)
```

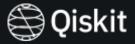
```
[<IBMQSimulator('ibmq_qasm_simulator') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_statevector') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_mps') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_extended_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQSimulator('simulator_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibm_nairobi') from IBMQ(hub='ibm-q', group='open', project='main')>]
7 qubits
```



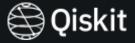
```
ibmq_account.backends(filters=lambda b: b.configuration().n_qubits > 5)
```



```
ibmq_account.backends(filters=lambda b: b.configuration().n_qubits > 5)
```

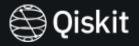


```
ibmq_account.backends(filters=lambda b: b.configuration().n_qubits > 5)
```



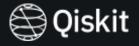
```
ibmq_account.backends(filters=lambda b: b.configuration().n_qubits > 5)
```

정확히 5 큐비트의 백엔드



```
[<IBMQBackend('ibmq_lima') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_belem') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_quito') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_manila') from IBMQ(hub='ibm-q', group='open', project='main')>]
```

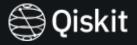
시뮬레이터를 제외한 백엔드



```
ibmq_account.backends(simulator=False, operational=True)
```

```
[<IBMQBackend('ibmq_lima') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_belem') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_quito') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibmq_manila') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibm_nairobi') from IBMQ(hub='ibm-q', group='open', project='main')>,
<IBMQBackend('ibm_oslo') from IBMQ(hub='ibm-q', group='open', project='main')>]
```

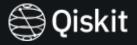
대기줄이 적은 백엔드



```
from qiskit.providers.ibmq import least_busy
least_busy(ibmq_account.backends(simulator=False, operational=True))
```

ibm_nairobi	7	32	2.6K	Online	17	Falcon r5.11H
ibm_oslo	7	32	2.6K	 Online 	53	Falcon r5.11H
ibmq_manila	5	32	2.8K	 Online 	8	Falcon r5.11L
ibmq_quito	5	16	2.5K	 Online 	4	Falcon r4T
ibmq_belem	5	16	2.5K	• Online	6	Falcon r4T
ibmq_lima	5	8	2.7K	Online	115	Falcon r4T

대기줄이 가장 적은 백엔드



```
from qiskit.providers.ibmq import least_busy

least_busy(ibmq_account.backends(simulator=False, operational=True))
```

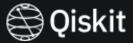
ibm_nairobi	7.	32	2.6K	Online	17	Falcon r5.11H
ibm_oslo	7	32	2.6K	 Online 	53	Falcon r5.11H
ibmq_manila	5	32	2.8K	Online	8	Falcon r5.11L
ibmq_quito	5	16	2.5K	• Online	4	Falcon r4T
ibmq_belem	5	16	2.5K	 Online 	6	Falcon r4T
ibmq_lima	5	8	2.7K	Online	115	Falcon r4T

<IBMQBackend('ibmq_quito') from IBMQ(hub='ibm-q', group='open', project='main')</pre>

백엔드 정보 추출



- name(): 백엔드의 이름을 불러옵니다
- provider(): 백엔드의 제공자를 불러옵니다.
- configuration(): 백엔드의 환경 정보를 불러옵니다.
- status(): 백엔드의 상태를 불러옵니다.
- properties(): 백엔드의 구성을 불러옵니다.
- jobs: 백엔드에 보내진 작업들을 불러옵니다.



Qiskit 도구

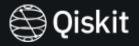
백엔드 개요 정보





```
ibmq_toronto
                            1bmg_montreal
                                                         ibm_oslo
Num. Oubits: 27
                             Num. Oubits: 27
                                                          Num. Oubits: 7
Pending Jobs: 39
                            Pending Jobs: 81
                                                         Pending Jobs: 55
Least busy:
             False
                            Least busy:
                                          False
                                                         Least busy:
                                                                       False
Operational: True
                            Operational: True
                                                         Operational: True
Avg. TI:
              103.4
                            Ave. T1:
                                          112.2
                                                         Ave. Ti:
                                                                       131.3
Avg. T2:
              109.5
                            AVE. T2:
                                          108.5
                                                                       96.0
                                                         Avg. T2:
ibm_nairobi
                            ibmo_manila
                                                         ibmg_quito
.........
Num. Qubits: 7
                            Num. Qubits: 5
                                                         Num. Qubits: 5
Pending Jobs: 24
                            Pending Jobs: 5
                                                         Pending Jobs: 5
                                                         Least busy:
Least busy:
             False
                            Least busy:
                                          False
                                                                       False
Operational: True
                            Operational: True
                                                         Operational: True
              127.9
                                          135.2
Avg. Ti:
                            Avg. Ti:
                                                         Avg. Ti:
                                                                       100.0
Ave. T2:
             75.4
                            Ave. T2:
                                          55.9
                                                                       112.8
                                                         AVE. T2:
1bmg_belem
                            ibmg_lima
                             ------
Num. Qubits: 5
                             Num. Qubits: 5
Pending Jobs: 5
                            Pending Jobs: 113
Least busy:
             False
                            Least busy:
                                          False
Operational: True
                            Operational: True
Avg. T1:
              190.0
                            Avg. T1:
                                          85.7
              121.4
                            Avg. T2:
                                          91.5
Avg. T2:
```

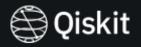
백엔드의 자세한 정보



<IBMQBackend('ibmq_quito') from IBMQ(hub='ibm-q', group='open', project='main')</pre>

```
from qiskit.tools import backend_monitor
backend_monitor(backend)
```

보낸 작업 모니터링



```
from qiskit.tools import job_monitor
job=execute(qc,backend,shots=1024)
job_monitor(job) # 작업의 진행 상황을 확인합니다.
```

Version Table





Version	Qiskit Software
0.21.0	qiskit-terra
0.10,4	qiskit-aer
0.19.2	qiskit-ibmq-provider
0.37.0	qiskit
	System information
3.10.5	Python version
Clang 13.0.1	Python compiler
main, Jun 14 2022 07:03:05	Python build
Darwir	OS
	CPUs
16.0	Memory (Gb)