

Qiskit 개발자 자격 시험

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Qiskit Advocate

- 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 백엔드 필터

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')>,  
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```

접근 가능한 백엔드 출력

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filter option

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<IBMQBackend('ibm_oslo') from IBMQ(hub='ibm-q', group='open', project='main')>]
```

5 큐비트가 넘는 백엔드

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

```
[<IBMQSimulator('ibmq_qasm_simulator') from IBMQ(hub='ibm-q', group='open', project='main')>,  
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<IBMQBackend('ibm_oslo') from IBMQ(hub='ibm-q', group='open', project='main')>] } 7 qubits
```


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```

```
[<IBMQSimulator('ibmq_qasm_simulator') from IBMQ(hub='ibm-q', group='open', project='main')>,  
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<IBMQBackend('ibm_oslo') from IBMQ(hub='ibm-q', group='open', project='main')>] } 32 qubits  
                                     } 7 qubits
```

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

```
[<IBMQSimulator('ibmq_qasm_simulator') from IBMQ(hub='ibm-q', group='open', project='main')>, } 32 qubits  
<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')>, —————> 63 qubits  
<IBMQSimulator('simulator_stabilizer') 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')>] } 7 qubits
```

5 큐비트가 넘는 백엔드

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

```
[<IBMQSimulator('ibmq_qasm_simulator') from IBMQ(hub='ibm-q', group='open', project='main')>, } 32 qubits  
<IBMQSimulator('simulator_statevector') from IBMQ(hub='ibm-q', group='open', project='main')>,  
<IBMQSimulator('simulator_mps') from IBMQ(hub='ibm-q', group='open', project='main')>, —————> 100 qubits  
<IBMQSimulator('simulator_extended_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>, —————> 63 qubits  
<IBMQSimulator('simulator_stabilizer') 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')>] } 7 qubits
```

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

```
[<IBMQSimulator('ibmq_qasm_simulator') from IBMQ(hub='ibm-q', group='open', project='main')>, } 32 qubits  
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<IBMQSimulator('simulator_mps') from IBMQ(hub='ibm-q', group='open', project='main')>, —————> 100 qubits  
<IBMQSimulator('simulator_extended_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>, —————> 63 qubits  
<IBMQSimulator('simulator_stabilizer') from IBMQ(hub='ibm-q', group='open', project='main')>, —————> 5000 qubits  
<IBMQBackend('ibm_nairobi') from IBMQ(hub='ibm-q', group='open', project='main')>, } 7 qubits  
<IBMQBackend('ibm_oslo') from IBMQ(hub='ibm-q', group='open', project='main')>]
```

정확히 5 큐비트의 백엔드

```
ibmq_account.backends(n_qubits=5)
```

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

ibmq_nairobi	7	32	2.6K	● Online	17	Falcon r5.11H
ibmq_oslo	7	32	2.6K	● Online	53	Falcon r5.11H
ibmq_manila	5	32	2.8K	● Online	8	Falcon r5.11L
<u>ibmq_quito</u>	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
<u>ibmq_quito</u>	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')
```


- `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



```
from qiskit.tools import backend_overview

backend_overview()

:
```

```
ibmq_toronto
-----
Num. Qubits: 27
Pending Jobs: 39
Least busy: False
Operational: True
Avg. T1: 103.4
Avg. T2: 109.5
```

```
ibmq_montreal
-----
Num. Qubits: 27
Pending Jobs: 81
Least busy: False
Operational: True
Avg. T1: 112.2
Avg. T2: 108.5
```

```
ibmq_oslo
-----
Num. Qubits: 7
Pending Jobs: 55
Least busy: False
Operational: True
Avg. T1: 131.3
Avg. T2: 96.0
```

```
ibmq_nairobi
-----
Num. Qubits: 7
Pending Jobs: 24
Least busy: False
Operational: True
Avg. T1: 127.9
Avg. T2: 71.4
```

```
ibmq_manila
-----
Num. Qubits: 5
Pending Jobs: 5
Least busy: False
Operational: True
Avg. T1: 135.2
Avg. T2: 55.9
```

```
ibmq_quito
-----
Num. Qubits: 5
Pending Jobs: 5
Least busy: False
Operational: True
Avg. T1: 100.0
Avg. T2: 112.0
```

```
ibmq_belem
-----
Num. Qubits: 5
Pending Jobs: 5
Least busy: False
Operational: True
Avg. T1: 100.0
Avg. T2: 121.4
```

```
ibmq_lima
-----
Num. Qubits: 5
Pending Jobs: 113
Least busy: False
Operational: True
Avg. T1: 85.7
Avg. T2: 91.5
```

백엔드의 자세한 정보

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



```
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

```
import qiskit.tools.jupyter

%qiskit_version_table
```

Version Information

Qiskit Software		Version
qiskit-terra		0.21.0
qiskit-aer		0.10.4
qiskit-ibmq-provider		0.19.2
qiskit		0.37.0
System information		
Python version		3.10.5
Python compiler		Clang 13.0.1
Python build		main, Jun 14 2022 07:03:09
OS		Darwin
CPUs		8
Memory (Gb)		16.0
Wed Aug 31 18:29:13 2022 KST		