QASM exporter: wrong order of gate definitions `Cannot find gate definition for 'rcccx'` #XXXX

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ANONYMOUS commented 2 days ago

Environment

- **Qiskit Terra version**: 0.19.1
- **Python version**: 3.8
- **Operating system**: Ubuntu 18.04.6 LTS

What is happening?

The qasm exporter gives an invalid qasm in the order of gate definition, this happens with `RC3XGate` and `C4XGate` in a subcircuit.

How can we reproduce the issue?

Run:

```
from qiskit import QuantumCircuit, ClassicalRegister, QuantumRegister
from qiskit.circuit.library.standard_gates import *
qr = QuantumRegister(5, name='qr')
cr = ClassicalRegister(5, name='cr')
qc = QuantumCircuit(qr, cr, name='qc')
qc.append(RC3XGate(), qargs=[qr[0], qr[1], qr[2], qr[3]], cargs=[])
subcircuit = QuantumCircuit(qr, name='subcircuit')
subcircuit.append(C4XGate(), qargs=[qr[0], qr[1], qr[2], qr[3], qr[4]])
qc.append(subcircuit, qargs=qr)
qc.measure(qr, cr)
qc.qasm(formatted=True)
```

Output:

```
OPENQASM 2.0;
include "qelib1.inc";
gate rcccx_dg q0,q1,q2,q3 { u2(-2*pi,pi) q3; u1(pi/4) q3; cx q2,q3; u1(-pi/4) q3; u2(-2*pi,pi) q3; u1(pi/4) q3;
gate mcx q0,q1,q2,q3,q4 { h q4; cu1(pi/2) q3,q4; h q4; rcccx q0,q1,q2,q3; h q4; cu1(-pi/2) q3,q4; h q4; rcccx_d
gate rcccx q0,q1,q2,q3 { u2(0,pi) q3; u1(pi/4) q3; cx q2,q3; u1(-pi/4) q3; u2(0,pi) q3; cx q0,q3; u1(pi/4) q3;
gate subcircuit q0,q1,q2,q3,q4 { mcx q0,q1,q2,q3,q4; }
qreg qr[5];
creg cr[5];
rcccx qr[0],qr[1],qr[2],qr[3];
subcircuit qr[0],qr[1],qr[2],qr[3],qr[4];
measure qr[0] -> cr[0];
measure qr[1] -> cr[1];
measure qr[2] -> cr[2];
measure qr[3] -> cr[3];
measure qr[4] -> cr[4];
```

Read the qasm, leads to error: `Cannot find gate definition for 'rcccx', line 4 file`

```
qc = QuantumCircuit.from_qasm_str(qc.qasm())
```

What should happen?

The generated qasm should have had `rcccx` and `mcx` definitions swapped.

Any suggestions?

Provided that #7148 will be fixed, then it would be sufficient to reorder the gate definition. Thus fixing this bug, with a post-processing reordering will probably benefit also #XXXX .
I am wondering if you think that this and #XXXX have the same root cause or they have different reason why they end up with out of order gate definitions?

These features of the program concur to produce the error (removing any of them result in a valid qasm):

- the RC3XGate
- the C4XGate (SPECIFICALLY in the subcircuit)

Looking forward to hearing your feedback on this situation, thanks in advance

Assignees
No one assigned

Labels
bug

Projects
None yet

Milestone
No milestone

Development
No branches or pull requests

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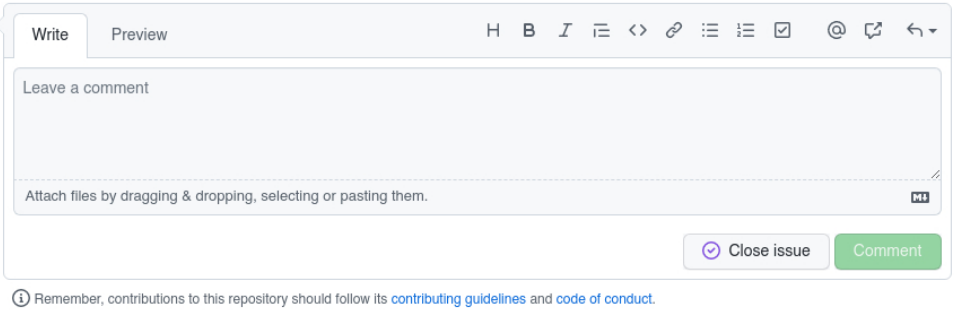
1 participant

Looking forward to hearing your feedback on this situation, thanks in advance

ANONYMOUS added the bug label 2 days ago



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