2025Year 1st Semester Syllabus

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Course Title	QUANTUM COMPUTING	Course Code-Section	CSI7101-01
Credit/Time/ Experiment,Lab,Practical Technique Time	3/Tue3,4,5	Department	Computer Science
Time	화3,4,5	Location	공D408
Exam Date & Time	Midterm exam	Final exam	
Class Language	English		

Instructor's Profile	Name	Burgstaller bernd	Contact Information	Telephone	02-2123-5728
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TA's Name & Contact Information	Name		Contact Information	Telephone	

Course Description Brief Introduction of the Course	Quantum computers have the potential to solve difficult computational problems for which no efficient classical algorithms exist. Writing quantum algorithms is radically different from programming classical computers and requires an understanding of quantum principles and the mathematical foundations behind them. This course introduces quantum computing from a computer science perspective, focusing on mathematical and algorithmic foundations. Course participants will gain practical experience by developing quantum programs in Qiskit and their simulation and execution on quantum processing units (QPUs) of the IBM Quantum Platform, particularly the Yonsei University Eagle QPU. Course goals: (1) Acquire a firm understanding of the quantum-mechanical foundations of qubit superposition, entanglement, and interference at the heart of all quantum computations. (2) Understand the early quantum algorithms such as Deutsch's Problem, Bernstein-Vazirani, and Quantum FFT, and be able to code and execute them on a QPU. (3) Know recent near-term quantum algorithms like the quantum simulation of Hamiltonian dynamics. (4) Understand and control, in principle, the quantum circuit compilation pipeline and error mitigation techniques to execute near-term quantum workloads on QPUs. The course will consist of lectures and at a later stage intersperse occasional workshops where course participants will work on specific practical programming problems.
Sustainable Development Goals	

Course Methods (%) Total Amount 100	Lecture	Practice Training	Presentation	Dabate	Team Project
	90%	10%	0%	0%	0%

Grading Policy(%) Total Amount 100 Free Input for Other Information	Midterm exam	Final exam	Quiz	Individual Assignment	Team Assignment	Attendance	Others
	40%	40%	0%	15%	0%	0%	5%

	Title of Assignment/Project Name, and Method of Filling Out	Submission Deadline	Type of Submission and Method

Assignment/ Report, Project Guide			
Prerequisite	The following courses are pre-requisistes : · An introductory programming class, e.g., CAS1100-01 is strictly required. · A course in linear algebra is strictly required.	온라인강의 사이트	

Course Material	Course Material Name	Author	Publisher	Publish Year	ISBN
참고자료	A Course in Quantum Computing (for the Community College), Volume 1,	Michael Loceff	https://lapastillaroja.net/wp-content/uploads/2016/09/Intro_to_QC_Vol_1_Loceff.pdf	2015	
참고자료	Quantum Information Science	Riccardo Manenti and Mario Motta	Oxford	2023	978-0198787488
참고자료	Quantum Algorithms via Linear Algebra (1st or 2nd edition)	Richard J. Lipton and Kenneth W. Regan	MIT Press	2021	9780262045254

Main Learner Precautions	This scheme is tentative and subject to change. Small problem sets will allow course participants to work on practical examples (algebra and coding) along with the course. For the workshops and in-class coding sessions, course participants are recommended to bring a laptop (sharing a laptop and working in groups is possible). The course is conducted in English. Yonsei University rules and regulations for plagiarism and un-excused absences apply.
Attatchment	

Weekly Plan

week	Period	Weekly Topic & Contents	Remarks
1		Admin, quantum information science	(3.4.) Spring semester classes begin (3.6.-3.10.) Course add/drop period
2		Hilbert space, single qubits and the Bloch sphere	
3		Single-qubit quantum gates, introduction to quantum circuits in Qiskit	
4		The experimental basis of quantum computing and the quantum postulates	
5		Quantum key distribution	
6		Tensors, bi-partite Hilbert space, and two-qubit gates	(4.8.-4.10.) Course withdrawal period
7		The no-cloning theorem, superdense coding	

8		Midterm exam	(4.22.-4.28.) Midterm Examinations
9		Quantum teleportation	(5.5.) Children's Day, Buddha's Birthday
10		Deutsch's algorithm, Bernstein-Vazirani's algorithm	(5.6.) Substitution Holiday
11		Quantum FFT	
12		Quantum simulation of Hamiltonian dynamics	
13		Introduction to error mitigation on near-term quantum devices	
14		Quantum circuit compilation pipeline with Qiskit	(6.6.) Memorial Day
15		Self-study week	(6.10.-6.16.) Make-up class week and reading period
16		Final exam	(6.17.-6.23.) Final Examinations

• Students with disabilities(SWDs) can request accommodations related to lectures, assignments, or tests by contacting t
he course professor at the beginning of semester.
(However, accommodations may vary depending on the essentiality of lecture and discretion of professors.)

[Lecture]
- Visual Impairment: alternative, braille, enlarged reading materials, note-taker
- Physical Impairment: alternative reading materials, access to classroom, note-taker, assigned seat
- Hearing Impairment: note-taker/stenographer, recording lecture
- Intellectual Disability/Autism: note-taker

[Assignments and Test]
- Visual/Physical/Hearing Impairment: (reasonable) extra days for submission, alternative type of assignment, extende
d test time, alternative type of test, arranging separate test room, and proctors, test ghostwriter
- Intellectual Disability/Autism: (reasonable) extra days for submission, alternative type of assignment