

Evaluating LLM Completion of Assessments in the CU MS-CS on Coursera Program

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INTRODUCTION

- How easily can an LLM be used to complete course assessments?
- Can an LLM pass an MS-CS course?

SUBJECT

- Two pathway specializations in the CU MS-CS on Coursera Program
 - Foundations of Data Structures and Algorithms
 - Network Systems: Principles and Practice

PROCESS

- Extract assessment content from Coursera
 - Multiple-choice quizzes
 - Programming assignments
- Load content to VS Code as .py, .ipynb, or .txt
- Use minimal prompting to ask Github Copilot Chat (with GPT-4o or GPT 4.1-Preview) to complete assessment
- Submit assessment in Coursera for grade with minimal modification of response

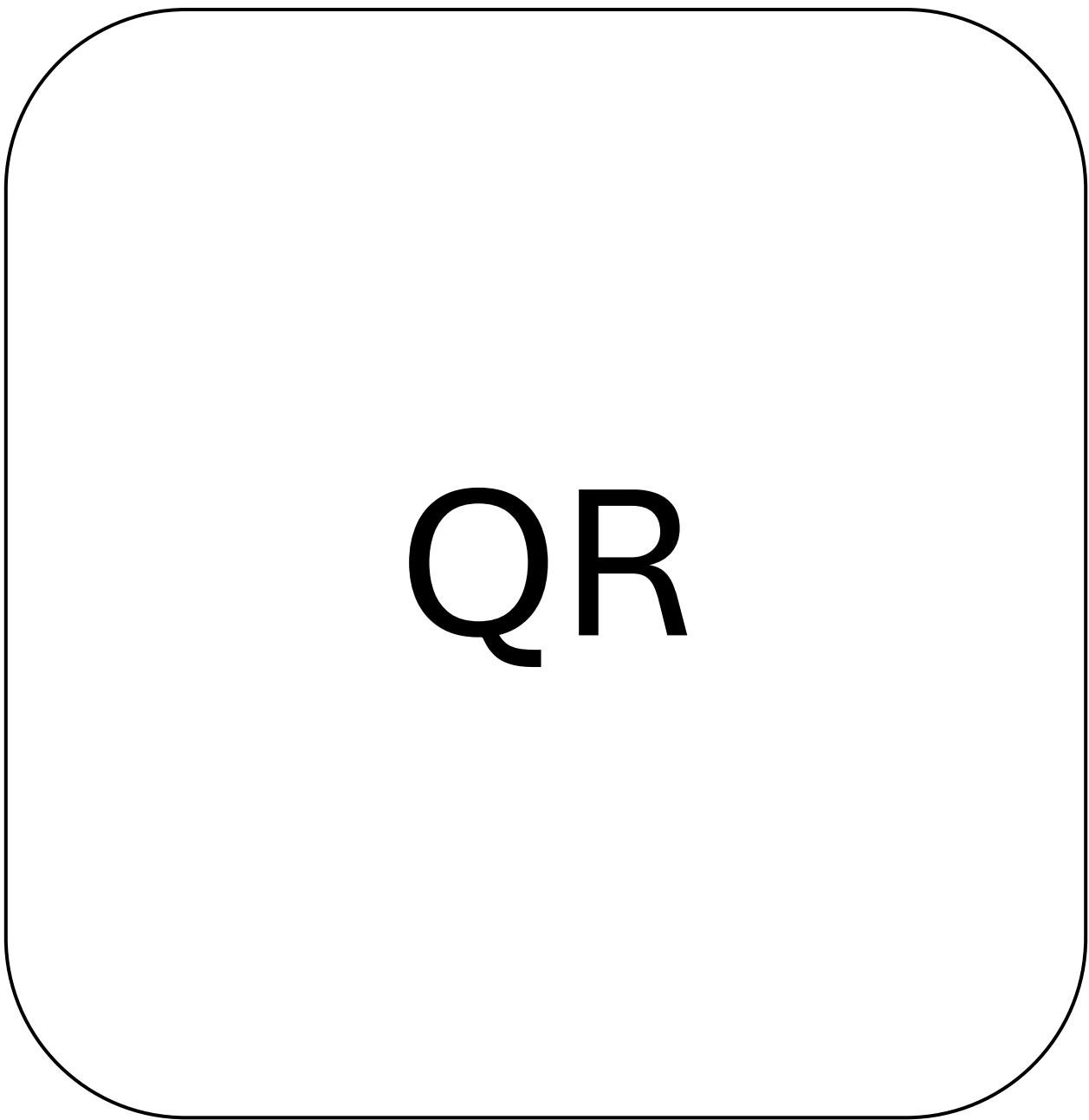
PROMPTS

- What are the correct answers for each question? Some of the questions could have multiple correct answers.*
- Correctly implement all points where comments say something like 'your code here' or 'raise NotImplementedError'*

OBSERVATIONS

- Most assessments completed with a single prompt
- Images/diagrams did not present a significant challenge
- Rare to refuse
- Reference to existing code in GitHub
- Context Matters
- Better results with programming assignments compared to quizzes
- Time to complete irrelevant
- Process could be used for any course with similar assessment formats

GitHub Copilot via VS Code can successfully complete assessments and pass courses.



RESULTS

Foundations of Data Structures and Algorithms C1 - Dynamic Programming, Greedy Algorithms (Grade 90.45)

Label	Assessment	Type	%	Est Time	Comp Time	Grade	Format
A1	Max Subarray Problem	Graded Assignment	2	30	5	66.57 MC Quiz	
A2	Karatsuba's Multiplication Algorithm	Graded Assignment	2	30	10	65.07 MC Quiz	
A3	Master Method	Graded Assignment	2	30	5	62.5 MC Quiz	
A4	Complex Numbers and Roots of Unity	Graded Assignment	2	30	5	75 MC Quiz	
A5	FFT Algorithm and Applications	Graded Assignment	2	30	5	75 MC Quiz	
A6	Problem Set 1	Programming Assignment	15	180	60	78 Jupyter Notebook - Python	
A7	Memoization	Graded Assignment	2	30	10	83.33 MC Quiz	
A8	Coinchanging Problem	Graded Assignment	2	30	5	66.42 MC Quiz	
A9	Knapsack Problem	Graded Assignment	2	30	5	87.5 MC Quiz	
A10	Longest Common Subsequence	Graded Assignment	2	30	10	76.76 MC Quiz	
A11	Problem Set 2	Programming Assignment	15	180	10	100 Jupyter Notebook - Python	
A12	Huffman Codes	Graded Assignment	2	30	5	60 MC Quiz	
A13	Problem Set 3	Programming Assignment	15	180	10	100 Jupyter Notebook - Python	
A14	Decision Problems and Languages	Graded Assignment	2	30	5	100 MC Quiz	
A15	Polynomial Time and Certificates	Graded Assignment	2	30	5	98 MC Quiz	
A16	NP Completeness Problems	Graded Assignment	2	30	5	87.5 MC Quiz	
A17	Problem Set 4	Programming Assignment	19	180	10	100 Jupyter Notebook - Python	
A18	Final	Graded Assignment	10	240	10	100 MC Quiz	

C2 - Approximation Algorithms and Linear Programming (Grade 86.58)

Label	Assessment	Type	%	Est Time	Comp Time	Grade	Format
A1	Basics of Linear Programs	Graded Assignment	2	30	5	68 MC Quiz	
A2	Solving LPs using PULP	Graded Assignment	2	30	5	92.3 MC Quiz	
A3	Network Flow Problems as LPs	Graded Assignment	2	30	10	32.5 MC Quiz	
A4	Geometry of Linear Programs	Graded Assignment	2	30	10	75 MC Quiz	
A5	LP Algorithms	Graded Assignment	2	30	5	50 MC Quiz	
A6	Linear Programming	Programming Assignment	11.75	180	15	100 Jupyter Notebook - Python	
A7	Integer Linear Programming	Graded Assignment	2	30	5	76.78 MC Quiz	
A8	Formulating/Solving ILPs	Graded Assignment	2	30	5	28 MC Quiz	
A9	Vertex Cover Problem ILP formulation	Graded Assignment	2	180	5	100 MC Quiz	
A10	Vertex Cover ILP, LP Relaxation and Integrality Gap	Graded Assignment	2	30	5	40 MC Quiz	
A11	Branch and Bound Solvers	Graded Assignment	2	30	5	74.66 MC Quiz	
A12	Integer Linear Programs	Programming Assignment	11.75	180	10	100 Jupyter Notebook - Python	
A13	Approximation Algorithm Basics	Graded Assignment	2	30	5	85 MC Quiz	
A14	Job Shop Scheduling Questions	Graded Assignment	2	30	5	70.9 MC Quiz	
A15	Vertex Cover	Graded Assignment	2	30	10	75 MC Quiz	
A16	Max-SAT Approximation	Graded Assignment	2	30	5	10 MC Quiz	
A17	Approximation Algorithms	Programming Assignment	11.75	180	10	100 Jupyter Notebook - Python	
A18	TSP Basics	Graded Assignment	2	30	10	80 MC Quiz	
A19	Held-Karp Algorithm	Graded Assignment	2	30	5	57.14 MC Quiz	
A20	TSP Integer Programming	Graded Assignment	2	30	5	54.16 MC Quiz	
A21	Approximations for Metric TSPs	Graded Assignment	2	30	10	76.51 MC Quiz	
A22	Fully Polynomial Time Approximation Scheme	Graded Assignment	2	30	5	88.88 MC Quiz	
A23	Travelling Salesperson Problems (TSP)	Programming Assignment	11.75	180	10	100 Jupyter Notebook - Python	
A24	Final	Programming Assignment	15	1800	10	100 Jupyter Notebook - Python	

C3 - Advanced Data Structures, RSA and Quantum Algorithms (Grade 53.74)

Label	Assessment	Type	%	Est Time	Comp Time	Grade	Format
A1	Quiz on Public Key Cryptography	Graded Assignment	3	20	5	91.66 MC Quiz	
A2	GCD and Euclid's Algorithm	Graded Assignment	3	30	5	62.5 MC Quiz	
A3	Bezout Coefficients	Graded Assignment	3	20	5	57.14 MC Quiz	
A4	Quiz on RSA	Graded Assignment	3	50	10	91.66 MC Quiz	
A5	Week 1 Programming Assignment	Programming Assignment	13	180	5	100 Jupyter Notebook - Python	
A6	Qubits	Graded Assignment	3	45	5	100 MC Quiz	
A7	Single Qubit Quantum Gates	Graded Assignment	3	45	5	100 MC Quiz	
A8	Multiple Qubit Quantum States	Graded Assignment	3	120	5	78.33 MC Quiz	
A9	Multiple Qubit Quantum Gates	Graded Assignment	3	40	5	77.5 MC Quiz	
A10	Quantum Parallelism and Implementing Classical Gates	Graded Assignment	3	45	5	75 MC Quiz	
A11	Week 2 Programming Assignment	Programming Assignment	13	180	N/A	N/A Jupyter Notebook - Python	
A12	Order Finding And Factoring	Graded Assignment	3	180	5	59.72 MC Quiz	
A13	Quantum Fourier Transform	Graded Assignment	3	60	5	64.44 MC Quiz	
A14	Week 3 Programming Assignment	Programming Assignment	13	180	N/A	N/A Jupyter Notebook - Python	
A15	Week 4 Programming Assignment	Programming Assignment	13	180	N/A	N/A Jupyter Notebook - Python	
A16	Final	Programming Assignment	15	180	5	100 Jupyter Notebook - Python	

Network Systems: Principles and Practice

C1 - Network Systems Foundation (Grade 86.91)

Label	Assessment	Type	%	Est Time	Comp Time	Grade	Format
A1	Link Layer	Graded Assignment	8	30	5	86.96 MC Quiz	
A2	Modifying Ethernet Frames	Programming Assignment	10	60	5	100 Jupyter Notebook - Python	
A3	Network Layer Quiz	Graded Assignment	8	30	5	85.71 MC Quiz	
A4	Network Layer - BGP Like Sim	Programming Assignment	10	180	5	100 Code File - Python	
A5	Transport Layer	Graded Assignment	8	30	5	100 MC Quiz	
A6	TCP - Find Max Bytes In Flight	Programming Assignment	10	120	TBD	TBD Code File - Python	
A7	gRPC Practice Code	Programming Assignment	0	60	N/A	N/A Code Files - Python	
A8	Application Layer	Graded Assignment	8	30	5	100 MC Quiz	
A9	Application Layer - Socket Programming	Programming Assignment	10	120	5	100 Code File - Python	
A10	Network Security	Graded Assignment	8	30	5	100 MC Quiz	
A11	Network Security Lab - Certificates	Programming Assignment	10	45	TBD	TBD Bash Script	
A12	Final	Graded Assignment	10	120	10	91.17 MC Quiz	

C2 - Linux Networking (Grade TBD)

Label	Assessment	Type	%	Est Time	Comp Time	Grade	Format
A1	Creating a Bridge	Programming Assignment	18	60	TBD	TBD Script Lab	
A2	Introduction to Linux Networking Summary	Graded Assignment	5	30	TBD	TBD MC Quiz	
A3	Peering a BGP Router	Programming Assignment	18.5	120	TBD	TBD Script Lab	
A4	IP Layer with Linux Networking Summary	Graded Assignment	5	30	TBD	TBD MC Quiz	
A5	Creating a Gateway with Linux Summary	Graded Assignment	5	30	TBD	TBD MC Quiz	
A6	Investigating Network Namespaces	Graded Assignment	18.5	120	TBD	TBD MC Quiz	
A7	Virtual Networking in Linux Summary	Graded Assignment	5	30	TBD	TBD MC Quiz	
A8	Kubernetes Networking with Linux Summary	Graded Assignment	5	30	TBD	TBD MC Quiz	
A9	Final	Graded Assignment	20	120	TBD	TBD MC Quiz	

C3 - Cloud Networking (Grade 71.34)

Label	Assessment	Type	%	Est Time	Comp Time	Grade	Format
A1	Starting Terraform with GCP	Graded Assignment	15	60	5	100 MC Quiz	
A2	Cloud Background Quiz	Graded Assignment	8	30	5	100 MC Quiz	
A3	Multiple VPCs with Terraform	Graded Assignment	15	90	5	22.22 MC Quiz	
A4	VPC Quiz	Graded Assignment	8	30	5	71.87 MC Quiz	
A5	WAN Module Lab	Graded Assignment	15	180	5	57.14 MC Quiz	
A6	WAN Quiz	Graded Assignment	8	30	5	91.66 MC Quiz	
A7	Network Services Quiz	Graded Assignment	8	30	5	75 MC Quiz	
A8	Hybrid Quiz	Graded Assignment	8	20	5	66.66 MC Quiz	
A9	Final	Graded Assignment	15	90	5	80.14 MC Quiz	