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

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QUESTIONS

- How easily can an LLM be used to complete course assessments?
- Can an LLM pass a graduate-level 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 LLM response
- One-Shot

PROMPTS

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

OBSERVATIONS

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

GitHub Copilot via VS Code **can** successfully **complete assessments and pass** graduate-level **courses**.

University of Colorado **Boulder**
Department of Computer Science

RESULTS

P1 - Foundations of Data Structures and Algorithms

C1 - Dynamic Programming, Greedy Algorithms (Grade 90.45)

Label	Assessment Title	Type	Grade %	Est. Mins	Comp. Mins	Grade	Format
P1-C1-A1	Max Subarray Problem	Graded Assignment	2	30	5	68.57	MC Quiz
P1-C1-A1	Karatsuba's Multiplication Algorithm	Graded Assignment	2	30	10	65.07	MC Quiz
P1-C1-A3	Master Method	Graded Assignment	2	30	5	62.5	MC Quiz
P1-C1-A4	Complex Numbers and Roots of Unity	Graded Assignment	2	30	5	75	MC Quiz
P1-C1-A5	FFT Algorithm and Applications	Graded Assignment	2	30	5	75	MC Quiz
P1-C1-A6	Problem Set 1	Programming Assignment	15	180	60	78	Jupyter Notebook - Python
P1-C1-A7	Memoization	Graded Assignment	2	30	10	83.33	MC Quiz
P1-C1-A8	Coinchanging Problem	Graded Assignment	2	30	5	66.42	MC Quiz
P1-C1-A9	Knapsack Problem	Graded Assignment	2	30	5	87.5	MC Quiz
P1-C1-A10	Longest Common Subsequence	Graded Assignment	2	30	10	76.76	MC Quiz
P1-C1-A11	Problem Set 2	Programming Assignment	15	180	10	100	Jupyter Notebook - Python
P1-C1-A12	Huffman Codes	Graded Assignment	2	30	5	60	MC Quiz
P1-C1-A13	Problem Set 3	Programming Assignment	15	180	10	100	Jupyter Notebook - Python
P1-C1-A14	Decision Problems and Languages	Graded Assignment	2	30	5	100	MC Quiz
P1-C1-A15	Polynomial Time and Certificates	Graded Assignment	2	30	5	80	MC Quiz
P1-C1-A16	NP Completeness Problems	Graded Assignment	2	30	5	87.5	MC Quiz
P1-C1-A17	Problem Set 4	Programming Assignment	19	180	10	100	Jupyter Notebook – Python
P1-C1-A18	Final	Graded Assignment	10	240	10	100	MC Quiz

C2 - Approximation Algorithms and Linear Programming (Grade 86.58)

Label	Assessment Title	Type	Grade %	Est. Mins	Comp. Mins	Grade	Format
P1-C2-A1	Basics of Linear Programs	Graded Assignment	2	30	5	68	MC Quiz
P1-C2-A2	Solving LPs using PULP	Graded Assignment	2	30	5	92.3	MC Quiz
P1-C2-A3	Network Flow Problems as LPs	Graded Assignment	2	30	10	32.5	MC Quiz
P1-C2-A4	Geometry of Linear Programs	Graded Assignment	2	30	10	75	MC Quiz
P1-C2-A5	LP Algorithms	Graded Assignment	2	30	5	50	MC Quiz
P1-C2-A6	Linear Programming	Programming Assignment	11.75	180	15	100	Jupyter Notebook - Python
P1-C2-A7	Integer Linear Programming	Graded Assignment	2	30	5	76.78	MC Quiz
P1-C2-A8	Formulating/Solving ILPs	Graded Assignment	2	30	5	28	MC Quiz
P1-C2-A9	Vertex Cover Problem ILP formulation	Graded Assignment	2	180	5	100	MC Quiz
P1-C2-A10	Vertex Cover ILP, LP Relaxation and Integrality Gap.	Graded Assignment	2	30	5	40	MC Quiz
P1-C2-A11	Branch and Bound Solvers	Graded Assignment	2	30	5	74.66	MC Quiz
P1-C2-A12	Integer Linear Programs	Programming Assignment	11.75	180	10	100	Jupyter Notebook - Python
P1-C2-A13	Approximation Algorithm Basics	Graded Assignment	2	30	5	85	MC Quiz
P1-C2-A14	Job Shop Scheduling Questions	Graded Assignment	2	30	5	70.9	MC Quiz
P1-C2-A15	Vertex Cover	Graded Assignment	2	30	10	75	MC Quiz
P1-C2-A16	Max-SAT Approximation	Graded Assignment	2	30	5	10	MC Quiz
P1-C2-A17	Approximation Algorithms	Programming Assignment	11.75	180	10	100	Jupyter Notebook - Python
P1-C2-A18	TSP Basics	Graded Assignment	2	30	10	80	MC Quiz
P1-C2-A19	Held-Karp Algorithm	Graded Assignment	2	30	5	57.14	MC Quiz
P1-C2-A20	TSP Integer Programming	Graded Assignment	2	30	5	54.16	MC Quiz
P1-C2-A21	Approximations for Metric TSPs	Graded Assignment	2	30	10	70.51	MC Quiz
P1-C2-A22	Fully Polynomial Time Approximation Scheme	Graded Assignment	2	30	5	88.88	MC Quiz
P1-C2-A23	Travelling Salesperson Problems (TSP)	Programming Assignment	11.75	180	10	100	Jupyter Notebook - Python
P1-C2-A24	Final	Programming Assignment	15	1800	10	100	Jupyter Notebook - Python

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

Label	Assessment Title	Type	Grade %	Est. Mins	Comp. Mins	Grade	Format
P1-C3-A1	Quiz on Public Key Cryptography	Graded Assignment	3	20	5	91.66	MC Quiz
P1-C3-A2	GCD and Euclid's Algorithm	Graded Assignment	3	30	5	62.5	MC Quiz
P1-C3-A3	Bezout Coefficients	Graded Assignment	3	20	5	57.14	MC Quiz
P1-C3-A4	Quiz on RSA	Graded Assignment	3	50	10	91.66	MC Quiz
P1-C3-A5	Week 1 Programming Assignment	Programming Assignment	13	180	5	100	Jupyter Notebook - Python
P1-C3-A6	Qubits	Graded Assignment	3	45	5	100	MC Quiz
P1-C3-A7	Single Qubit Quantum Gates	Graded Assignment	3	45	5	100	MC Quiz
P1-C3-A8	Multiple Qubit Quantum States	Graded Assignment	3	120	5	78.33	MC Quiz
P1-C3-A9	Multiple Qubit Quantum Gates	Graded Assignment	3	40	5	77.5	MC Quiz
P1-C3-A10	Quantum Parallelism and Implementing Classical Gates	Graded Assignment	3	45	5	75	MC Quiz
P1-C3-A11	Week 2 Programming Assignment	Programming Assignment	13	180	N/A	N/A	Jupyter Notebook - Python
P1-C3-A12	Order Finding And Factoring	Graded Assignment	3	180	5	59.72	MC Quiz
P1-C3-A13	Quantum Fourier Transform	Graded Assignment	3	60	5	64.44	MC Quiz
P1-C3-A14	Week 3 Programming Assignment	Programming Assignment	13	180	N/A	N/A	Jupyter Notebook - Python
P1-C3-A15	Week 4 Programming Assignment	Programming Assignment	13	180	N/A	N/A	Jupyter Notebook - Python
P1-C3-A16	Final	Programming Assignment	15	180	5	100	Jupyter Notebook - Python

P2 - Network Systems: Principles and Practice

C1 - Network Systems Foundation (Grade 86.91)

Label	Assessment Title	Type	Grade %	Est. Mins	Comp. Mins	Grade	Format
P2-C1-A1	Link Layer	Graded Assignment	8	30	5	86.66	MC Quiz
P2-C1-A2	Modifying Ethernet Frames	Programming Assignment	10	60	5	100	Jupyter Notebook - Python
P2-C1-A3	Network Layer Quiz	Graded Assignment	8	30	5	85.71	MC Quiz
P2-C1-A4	Network Layer - BGP Like Sim	Programming Assignment	10	180	5	100	Code File - Python
P2-C1-A5	Transport Layer	Graded Assignment	8	30	5	100	MC Quiz
P2-C1-A6	TCP - Find Max Bytes In Flight	Programming Assignment	10	120	TBD	TBD	Code File - Python
P2-C1-A7	gRPC Practice Code	Programming Assignment	0	60	N/A	N/A	Code Files - Python
P2-C1-A8	Application Layer	Graded Assignment	8	30	5	100	MC Quiz
P2-C1-A9	Application Layer - Socket Programming	Programming Assignment	10	120	5	100	Code File - Python
P2-C1-A10	Network Security	Graded Assignment	8	30	5	100	MC Quiz
P2-C1-A11	Network Security Lab - Certificates	Programming Assignment	10	45	TBD	TBD	Bash Script
P2-C1-A12	Final	Graded Assignment	10	120	10	91.17	MC Quiz

C2 - Linux Networking (Grade TBD)

Label	Assessment Title	Type	Grade %	Est. Mins	Comp. Mins	Grade	Format
P2-C2-A1	Creating a Bridge	Programming Assignment	18	60	TBD	TBD	External Lab
P2-C2-A2	Introduction to Linux Networking Summary	Graded Assignment	5	30	TBD	TBD	MC Quiz
P2-C2-A3	Peering a BGP Router	Programming Assignment	18.5	120	TBD	TBD	External Lab
P2-C2-A4	IP Layer with Linux Networking Summary	Graded Assignment	5	30	TBD	TBD	MC Quiz
P2-C2-A5	Creating a Gateway with Linux Summary	Graded Assignment	5	30	TBD	TBD	MC Quiz
P2-C2-A6	Investigating Network Namespaces	Graded Assignment	18.5	120	TBD	TBD	MC Quiz
P2-C2-A7	Virtual Networking in Linux Summary	Graded Assignment	5	30	TBD	TBD	MC Quiz
P2-C2-A8	Kubernetes Networking with Linux Summary	Graded Assignment	5	30	TBD	TBD	MC Quiz
P2-C2-A9	Final	Graded Assignment	20	120	TBD	TBD	MC Quiz

C3 - Cloud Networking (Grade 71.34)

Label	Assessment Title	Type	Grade %	Est. Mins	Comp. Mins	Grade	Format
P2-C3-A1	Starting Terraform with GCP	Graded Assignment	15	60	5	100	MC Quiz
P2-C3-A2	Cloud Background Quiz	Graded Assignment	8	30	5	100	MC Quiz
P2-C3-A3	Multiple VPCs with Terraform	Graded Assignment	15	90	5	22.22	MC Quiz
P2-C3-A4	VPC Quiz	Graded Assignment	8	30	5	71.87	MC Quiz
P2-C3-A5	WAN Module Lab	Graded Assignment	15	180	5	57.14	MC Quiz
P2-C3-A6	WAN Quiz	Graded Assignment	8	30	5	91.66	MC Quiz
P2-C3-A7	Network Services Quiz	Graded Assignment	8	30	5	75	MC Quiz
P2-C3-A8	Hybrid Quiz	Graded Assignment	8	20	5	66.66	MC Quiz
P2-C3-A9	Final	Graded Assignment	15	90	5	80.14	MC Quiz