Aids Allowed: ONLY your *own notes* taken during lectures and office hours, the lecture *slides and recordings* (for all sections), and the *Course Notes* (textbook).

Submission Instructions

- Submit your work directly on **MarkUs**—even if you are late!
- You may type your answers or hand-write them *legibly*, on paper or using a tablet and stylus.
- You may write your answers directly on the question paper, or on another piece of paper/document.
- You may submit your answers as a single file/document or as multiple files/documents. Each document may contain answers for only part of one question, an entire question, or multiple questions, but *please label each part of your answers* to make it clear what you are answering.
- There is no "required file", *but please give short names to your file(s)*, like "`Q2.png`" or "`TT4.pdf`".
- You **must** submit your answers in PDF or as photos (JPEG/JPG/GIF/PNG/HEIC/HEIF). **Other formats** (e.g., Word documents, LaTeX source files, ZIP files) **are NOT accepted**—you must **export** or **compile** documents to PDF, **convert** images into a supported format, and upload each file **individually**.

For all questions in this test, write your proofs *formally*, including a header and a proof body with justifications for each deduction. Remember that we are looking for evidence that you understand the conventions for writing correct proofs, so pay attention to the *structure* of your answers, in addition to their content!

1. [8 marks] Short-Answer Questions

(a) **[2 marks]**
Give two graphs $G_1 = (V_1, E_1)$ and $G_2 = (V_2, E_2)$ such that $|V_1| = |V_2| = 6$ and $|E_1| = |E_2| = 7$ and G_1 is **not** connected and G_2 is **connected**. You may draw a picture of each graph, or simply list the elements in the sets V_1, E_1 and V_2, E_2 for each graph.

(b) **[2 marks]**
Prove or disprove the following statement: "There exists a non-empty graph $G = (V, E)$ such that every edge in E belongs to some cycle in G, and G contains at least two different cycles."

(c) **[2 marks]**
Prove that $n + (1/n) \in \Theta(n)$.
In your answer, you **cannot** use facts from Theorems 5.1–5.9 in the Course Notes.

(d) **[2 marks]** Compute the value of each expression below. Write your answers in **decimal** notation and show your work.

i. $(12)_8 + (40)_{16}$
ii. $(401)_{10} + (1111)_2$