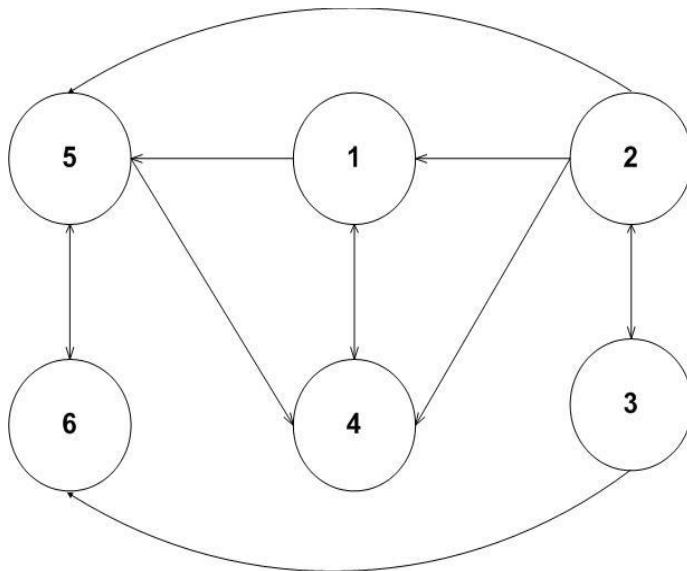# DATA 468 Homework 5

Instructor: Zakir Ullah
Homework Date: May 03, 2025
Submission Date: May 10, 2025 (11:00 PM) (Beijing Time)
Submission Date in Gradescope: May 10, 2025 (8:00 AM) (Tucson Time)

Instructions: Please write or type your solutions clearly and show all relevant steps. Once you are done, please upload your solutions to Gradescope. Ifyou need to scan your solutions, please use a free scanning app like CamScanner instead of sending photographs. Please submit your solutions within the prescribed time, as late submissions will be notconsidered.

1. Given the following Markov Chain

$$P = \begin{bmatrix} 0.1 & 0.0 & 0.0 & 0.4 & 0.5 & 0.0 \\ 0.1 & 0.2 & 0.2 & 0.0 & 0.5 & 0.0 \\ 0.0 & 0.1 & 0.3 & 0.0 & 0.0 & 0.6 \\ 0.1 & 0.0 & 0.0 & 0.9 & 0.0 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.4 & 0.0 & 0.6 \\ 0.0 & 0.0 & 0.0 & 0.0 & 0.5 & 0.5 \end{bmatrix}$$

(a) Identify set of all closed sates.

(b) Identify communicating states.

(c) Identify the irreducible sates.

(e) Identify transient and recurrent sates

Note: Please justify your answers by explaining them in details.

a. state1 → 1, 4, 5
   state4 → 1, 4
   state5 → 4, 6
   state6 → 5, 6
   closed states: $\{1, 4, 5, 6\}$

b. $\{1, 4, 5, 6\}$: $(1 \to 5 \to 6 \to 5 \to 4 \to 1)$

   $\{2, 3\}$: $2 \leftrightarrow 3$

c. $\{1, 4, 5, 6\}$

e. transient state : $\{2, 3\}$
   recurrent state : $\{1, 4, 5, 6\}$