Use pencil, please.

Place **ANSWERS ONLY** in the boxes.

**ANSWER IN FRACTION FORM WHEN APPLICABLE.**

Given the following transition matrix:

\[
P = \begin{bmatrix}
  0.4 & 0.6 \\
  0.8 & 0.2 \\
\end{bmatrix}
\]

1) Find the probability of moving from state 1 to state 2 in one observation.

A) 0.5  B) 0.6  C) 0.8  D) 0.36  E) None of these

2) Find the initial probability distribution if the system is initially in state 2.

A) \< 0.8, 0.2 >  B) \< 0.6, 0.2 >  C) \< 1, 0 >  D) \< 0, 1 >  E) None of these

3) If the system is initially in state 2, then find the probability distribution after 3 observations.

A) \< 0.608, 0.392 >  B) \< 0.512, 0.008 >  C) \< 0.5568, 0.4432 >  D) \< 0, 1 >  E) None of these

4) Find the fixed probability vector (t).

A) \< 1, 0 >  B) \< 2, 1 >  C) \< 7, 3 >  D) \< 4, 6 >  E) None of these

If a mouse is placed into the enclosure to the left, it moves as follows:

If the mouse is in any particular room, it can either stay in the room or go out of any of the room's doors, each option having the same probability. For example, if it is in room 2, it is more likely to go to room 1 than anything else because there are two doors leading there.

5) If the mouse is in room 1, find the probability that it moves to room 3 for the next observation.

A) \( \frac{1}{2} \)  B) \( \frac{1}{3} \)  C) \( \frac{1}{4} \)  D) \( \frac{1}{5} \)  E) None of these

6) If the mouse is in room 3, find the probability that it moves to room 2 for the next observation.

A) \( \frac{1}{2} \)  B) \( \frac{1}{3} \)  C) \( \frac{1}{4} \)  D) \( \frac{1}{5} \)  E) None of these

7) If the mouse is in room 3, find the probability that it stays there for the next observation.

A) \( \frac{1}{2} \)  B) \( \frac{1}{3} \)  C) \( \frac{1}{4} \)  D) \( \frac{1}{5} \)  E) None of these

8) If the mouse is in room 3, find the probability that it moves to room 4 for the next observation.

A) \( \frac{1}{2} \)  B) \( \frac{1}{3} \)  C) \( \frac{3}{4} \)  D) \( \frac{3}{5} \)  E) None of these

9) If the mouse starts in room 2, which room will it most likely be in after 3 observations?

A) Room 1  B) Room 2  C) Room 3  D) Room 4  E) None of these

10) If the mouse starts in room 2, which room will it most likely be in after 7 observations?

A) Room 1  B) Room 2  C) Room 3  D) Room 4  E) None of these

(Problems 11 and 12) Is the Markov chain whose transition matrix is given regular? Answer YES or NO.

11) \[
\begin{bmatrix}
  0.3 & 0.7 \\
  1 & 0 \\
\end{bmatrix}
\]

12) \[
\begin{bmatrix}
  1 & 0 \\
  0.2 & 0.8 \\
\end{bmatrix}
\]
WGI and Breadisus are two rival wheat suppliers (and they are the only two in an area). In that area each month, 12% of WGI’s customers switch to Breadisus, and 8% of Breadisus’ customers switch to WGI. Currently, 58% of the customers are with WGI, and the rest are with Breadisus. (Let WGI be state 1 and Breadisus be state 2)

13) Find the Initial probability distribution (Current).
   A) < .58  .42 >   B) < .5  .5 >   C) < 1  0 >   D) < 0  1 >   E) None of these

14) Find the transition matrix for the system.
   A) \[
   \begin{bmatrix}
   0 & .12 \\
   .08 & 0 \\
   \end{bmatrix}
   \]   B) \[
   \begin{bmatrix}
   .88 & .12 \\
   .08 & .92 \\
   \end{bmatrix}
   \]   C) \[
   \begin{bmatrix}
   .88 & .12 \\
   .2 & .8 \\
   \end{bmatrix}
   \]   D) \[
   \begin{bmatrix}
   .88 & .12 \\
   .92 & .08 \\
   \end{bmatrix}
   \]   E) None of these

15) To the nearest percent, what portion of the customers will Breadisus hold after 4 months?
   A) 47%   B) 49%   C) 51%   D) 53%   E) None of these

16) Find the fixed probability vector (t) (fraction form)
   A) \[
   \begin{bmatrix}
   2/5 \\
   3/5 \\
   \end{bmatrix}
   \]   B) \[
   \begin{bmatrix}
   1/2 \\
   1/2 \\
   \end{bmatrix}
   \]   C) \[
   \begin{bmatrix}
   3/4 \\
   1/4 \\
   \end{bmatrix}
   \]   D) \[
   \begin{bmatrix}
   1/5 \\
   4/5 \\
   \end{bmatrix}
   \]   E) None of these

17) What portion of the area’s customers will WGI eventually hold? (fraction)
   A) \[
   \begin{bmatrix}
   1/2 \\
   \end{bmatrix}
   \]   B) \[
   \begin{bmatrix}
   1/5 \\
   \end{bmatrix}
   \]   C) \[
   \begin{bmatrix}
   2/5 \\
   \end{bmatrix}
   \]   D) \[
   \begin{bmatrix}
   3/4 \\
   \end{bmatrix}
   \]   E) None of these