

Problems #1-9: Identify the best answer from the given choices. Place the letter on the answer line.

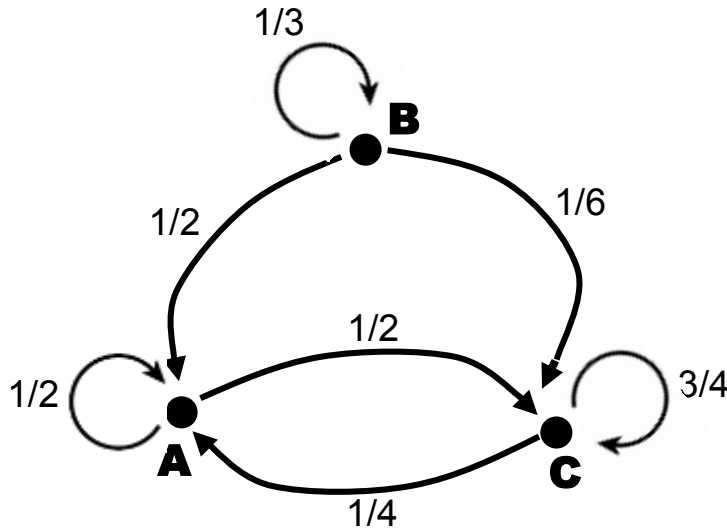
1) Find the values of a , b , c , and d that would make T a transition matrix.

$$T = \begin{bmatrix} a & 0.35 & b \\ 0.30 & 0.60 & c \\ 0.45 & d & 0.25 \end{bmatrix}$$

- A. $a=0.25$ $b=0.40$ $c=0.10$ $d=0.30$
- B. $a=0.25$ $b=0.45$ $c=0.30$ $d=0.05$
- C. $a=0.40$ $b=0.45$ $c=0.10$ $d=0.30$
- D. $a=0.25$ $b=0.30$ $c=0.10$ $d=0.30$
- E. $a=-0.25$ $b=-0.10$ $c=-0.90$ $d=-0.70$

Answer to #1 _____

2) Which transition matrix represents the diagram below?



- A. $T = \begin{bmatrix} \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{3} & \frac{1}{6} \\ 0 & \frac{1}{4} & \frac{3}{4} \end{bmatrix}$
- B. $T = \begin{bmatrix} \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{6} & \frac{1}{3} & \frac{1}{2} \\ 0 & \frac{1}{4} & \frac{3}{4} \end{bmatrix}$
- C. $T = \begin{bmatrix} \frac{1}{4} & 0 & \frac{3}{4} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{3} & \frac{1}{6} \end{bmatrix}$
- D. $T = \begin{bmatrix} \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{3} & \frac{1}{6} \\ \frac{1}{4} & 0 & \frac{3}{4} \end{bmatrix}$
- E. $T = \begin{bmatrix} \frac{1}{2} & \frac{1}{3} & \frac{1}{6} \\ \frac{1}{4} & 0 & \frac{3}{4} \\ \frac{1}{2} & 0 & \frac{1}{2} \end{bmatrix}$

Answer to #2 _____

3) For the transition matrix T find the probability of moving from state C to state A after 1 transition.

$$T = \begin{matrix} & \begin{matrix} A & B & C \end{matrix} \\ \begin{matrix} A \\ B \\ C \end{matrix} & \begin{bmatrix} 0.30 & 0.10 & 0.60 \\ 0.50 & 0.20 & 0.30 \\ 0.20 & 0.10 & 0.70 \end{bmatrix} \end{matrix}$$

- A. 0.20
- B. 0.25
- C. 0.63
- D. 0.26
- E. 0.60

Answer to #3 _____

4) For the transition matrix T find the probability of moving from state C to state A after 2 transitions.

$$T = \begin{matrix} & \begin{matrix} A & B & C \end{matrix} \\ \begin{matrix} A \\ B \\ C \end{matrix} & \begin{bmatrix} 0.30 & 0.10 & 0.60 \\ 0.50 & 0.20 & 0.30 \\ 0.20 & 0.10 & 0.70 \end{bmatrix} \end{matrix}$$

- A. 0.20
- B. 0.25
- C. 0.63
- D. 0.26
- E. 0.60

Answer to #4 _____

5) Sammy the slugger's performance on the baseball diamond is influenced by his state of mind. If Sammy did not get a base hit last time, he has a 40% chance of getting a hit next time; whereas, if he got a base hit last time, he has a 50% chance of getting a base hit next time. If Sammy just got a base hit, what is the probability that he will get a base hit two at bats from now?

- A. 0.46
- B. 0.56
- C. 0.54
- D. 0.55
- E. 0.45

Answer to #5 _____

6) Given the initial state vector and transition matrix below, find P_2

$$P_0 = [0.35 \quad 0.65] ; T = \begin{bmatrix} 0.51 & 0.49 \\ 0.67 & 0.33 \end{bmatrix}$$

- A. $P_2 = [0.6140 \quad 0.3860]$
- B. $P_2 = [0.3828 \quad 0.6172]$
- C. $P_2 = [0.4970 \quad 0.5030]$
- D. $P_2 = [0.5718 \quad 0.4282]$
- E. $P_2 = [0.4735 \quad 0.5265]$

Answer to #6 _____

7) A student has the following attendance pattern. If he is present in class one day, the probability he will be present the next day is 0.65. If he is absent from class one day, the probability he will be present the next day is 0.32. If he attended class today and it's Monday, what is the probability that he will be absent on Tuesday?

- A. 0.123
- B. 0.35
- C. 0.65
- D. 0.535
- E. 0.466

Answer to #7 _____

8) A student has the following attendance pattern. If he is present in class one day, the probability he will be present the next day is 0.65. If he is absent from class one day, the probability he will be present the next day is 0.32. In the long run, what percentage of days will he be present?

- A. $\frac{1}{2}$
- B. $\frac{68}{133}$
- C. $\frac{32}{67}$
- D. $\frac{65}{133}$
- E. $\frac{35}{67}$

Answer to #8 _____

9) Fill in the blank. The following transition matrix is _____.

$$T = \begin{bmatrix} 0.80 & 0.10 & 0.10 \\ 0 & 1 & 0 \\ 0.20 & 0.30 & 0.50 \end{bmatrix}$$

- A. Not irreducible and not regular
- B. Irreducible but not regular
- C. Not irreducible but regular
- D. Irreducible and regular
- E. None of the above

Answer to #9 _____

#10-14: Show all your work.

10) A Markov chain is represented by the transition matrix below.

- (a) Draw a transition diagram for this Markov chain
- (b) Determine whether this Markov chain is irreducible
- (c) Determine whether this Markov chain is regular

$$T = \begin{array}{c} \text{A} \\ \text{B} \\ \text{C} \end{array} \begin{array}{ccc} \text{A} & \text{B} & \text{C} \\ \left[\begin{array}{ccc} \frac{1}{3} & \frac{2}{3} & 0 \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & \frac{1}{3} & \frac{2}{3} \end{array} \right] \end{array}$$

(a) Transition diagram

(b) The Markov chain is (circle): Irreducible / Not Irreducible

(c) The Markov chain is (circle): Regular / Not Regular

11) Given that $P_0 = [0.90 \quad 0.10]$ and $T = \begin{bmatrix} 0.36 & 0.64 \\ 0.78 & 0.22 \end{bmatrix}$, find P_2 .

Show all calculations to 4 decimal places.

Answer to #11 _____

12) Sharpe's and Blue City are two window repair companies. Neither company has achieved 100% customer loyalty in their town: 15% of Sharpe's customers call Blue City for their next repair and 35% of Blue City's customers take their next job to Sharpe's. What is the probability that a customer who currently uses Blue City will use Sharpe's three transitions from now? (Hint: find T^3). Round your answer to 4 decimal places.

Answer to #12 _____

13) A university consists of three colleges: business (B), science (S) and fine arts (F). Each year, there is a 15% probability of a student in the college of business changing to science and a 10% probability of changing to fine arts. There is a 5% probability of a student in the college of science changing to business and a 20% probability of changing to fine arts. A fine arts major has a 5% probability of changing to science and a 15% probability of changing to business.

a) Set up the transition matrix using the letters B, S, and F.

$$T = \begin{matrix} & \begin{matrix} B & S & F \end{matrix} \\ \begin{matrix} B \\ S \\ F \end{matrix} & \left[\begin{array}{ccc} & & \\ & & \\ & & \end{array} \right] \end{matrix}$$

b) Currently, the breakdown of the university is 40% business, 50% science, and 10% fine arts. What will the breakdown be after 1 year?

Answer to #13b _____

14) Find the steady state vector of the following regular matrix:

$$T = \begin{bmatrix} 0 & 0 & 1 \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$$

Answer to #14 _____