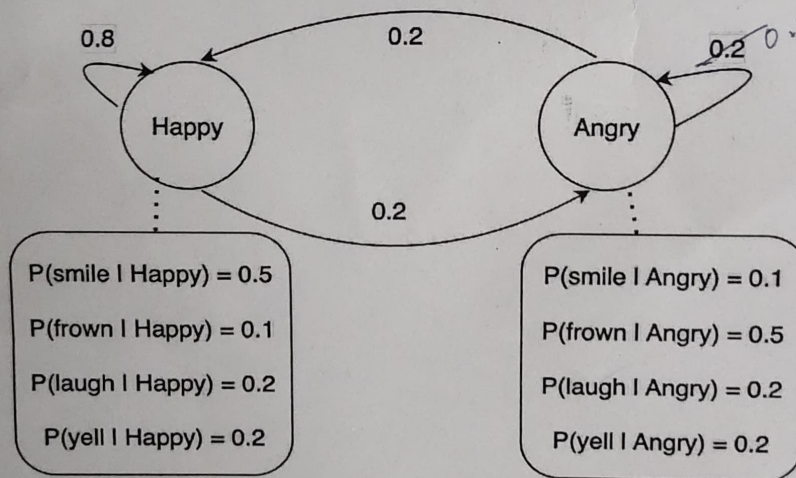


**NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI-15**  
**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**  
**B.TECH. DEGREE, VII SEMESTER, II CYCLE TEST, OCT-2025**  
**CSPE73 – Natural Language Processing**

**DATE: 16-10-2025**      **TIME: 11.00 a.m. – 12.00 p.m.**  
**Answer all the Questions**

**MAX.MARKS:20 marks**  
**5 x 4=20 marks**

1. Briefly explain the modern Text to Speech pipeline.
2. Find the similarity between two documents using cosine similarity. Use Bag of words for the vector representation of the documents.  
 Document 1: "Deep Learning can be hard"  
 Document 2: "Deep Learning can be simple"
3. Explain the architecture of the Question Answering system briefly.
4. Write short notes on the different approaches used in the Machine Translation.
5. Mr. X is happy someday and angry on other days. We can only observe when he smiles, frowns, laughs, or yells but not his actual emotional state. Let us start on day 1 in the happy state. There can be only one state transition per day. It can be either to happy state or angry state. The HMM is shown below;



Assume that  $q_t$  is the state on day  $t$  and  $o_t$  is the observation on day  $t$ . Answer the following

- (a) What is  $P(q_2 = \text{Happy})$ ? *0.8*
- (b) What is  $P(o_2 = \text{frown})$ ? *0.18*
- (c) What is  $P(q_2 = \text{Happy} | o_2 = \text{frown})$ ? *0.44*
- (d) What is  $P(o_1 = \text{frown } o_2 = \text{frown } o_3 = \text{frown } o_4 = \text{frown } o_5 = \text{frown}, q_1 = \text{Happy } q_2 = \text{Angry } q_3 = \text{Angry } q_4 = \text{Angry } q_5 = \text{Angry})$  if  $\pi = [0.7, 0.3]$ ?

-----Best Wishes-----

*Handwritten calculations:*  
 $0.8 \times 0.8 = 0.64$   
 $0.8 \times 0.2 = 0.16$   
 $0.2 \times 0.8 = 0.16$   
 $0.2 \times 0.2 = 0.04$   
 $0.64 + 0.16 + 0.16 + 0.04 = 1.0$

*Handwritten calculations:*  
 $0.5 \times 0.5 = 0.25$   
 $0.5 \times 0.2 = 0.1$   
 $0.2 \times 0.5 = 0.1$   
 $0.2 \times 0.2 = 0.04$   
 $0.25 + 0.1 + 0.1 + 0.04 = 0.49$