Cycle Test - I
CSPE73 – Natural Language Processing (Program Elective)

Class / Semester : IV CSE / VII **Time** : 3.30 PM to 4.30 PM
Date : 28.08.2024 **Marks : 20** **Section : A**

Answer all questions

1. Write the Regular Expressions for the following patterns. (5)
   a. a string that matches any price in the form of $3.45 or $23.32 or $400.
   b. a string that captures a URL that only consists of characters, numbers, underscore and dots. For example: www.abc.com, def_ghi.com, a678.cn. Note that dots(".") should not appear consecutively and should not appear as the first or last character. The dot must appear at least once
   c. a string that captures words that start with a vowel (a, e, i, o, u), can have any number of characters from a-z after the vowel and end with a consonant (any letters that are not a, e, i, o, u). For example, it should match "unicorn", "it", and "element".
   d. a pattern that matches the strings that has an 'a' followed by any alphabets or digits or both ending in 'b'.
   e. a pattern that matches the strings that has an *a* followed by one or more b's followed by 3 to 7 number of c's.

2. Match the following misspelt words with their corresponding Confusion matrices in Statistical Spell Checking. (5)

S.No	Correct Word	Misspelt Word
1	accidentally	accidentaly
2	category	catagory
3	foreign	foriegn
4	abandoned	abandonned
5	conscious	consious

3. Construct the Combined Finite State Automata for the following pairs of words.
   a. Universal and University   b. Loyal and Royal (5)
   c. Better and Butter   d. Creature and Creativity
   e. Spouse and Mouse

4. Draw the pronunciation networks for the words **"Receive"** and **"Yellow"** using Markov model and Hidden Markov Model. (5)

Cycle Test - II
CSPE73 – Natural Language Processing (Elective)

Class / Semester : IV CSE / VII   Time: 10.30 AM to 11.30 AM
Date   : 16.10.2024   Marks : 20   Section : A & B

Answer all questions

1. Perform the Word Sense Disambiguation using Selection Restriction approach for the following pairs of sentences by identifying the corresponding restriction words. **(4)**

   a. I can hear bass sound.
      John likes to eat grilled bass.

   b. Sachin buy a branded bat for his upcoming cricket match.
      Mary saw a bat hanging on a banyan tree.

2. Consider the CNF grammar G defined for a language L. **(8)**

   $$S \rightarrow AB \mid BC$$
   $$A \rightarrow BA \mid a$$
   $$B \rightarrow CC \mid b$$
   $$C \rightarrow AB \mid a$$

   Check whether the string **aba** $\in$ L(G) or not using **CYK** parsing.

3. Consider the grammar G given below.

S	$\rightarrow$	NP VP | Wh NP VP | Wh NP Aux NP VP
S	$\rightarrow$	Aux NP VP | VP
NP	$\rightarrow$	Proper-Noun | Personal Pronoun | NP PP | Noun
NP	$\rightarrow$	Determiner Nominal | Possessive Pronoun Noun
Nominal	$\rightarrow$	Noun | Noun Nominal
Nominal	$\rightarrow$	Adjective Nominal
PP	$\rightarrow$	Preposition NP
VP	$\rightarrow$	Verb | Verb NP | Verb PP

   By using the above grammar, perform Top-Down as well as Bottom-Up Parsing for the following sentences and generate the corresponding parse trees. **(8)**
   i.   Does this flight serve dinner?
   ii.   John ate that black chocolate.
   iii. Which book do you borrow from the library?

28/08/24   TIME: 60 Mins   Max: 20 marks

ANSWER ALL THE QUESTIONS

1. Explain the 4, 8 and m connectivity of pixels with the help of an example   (3)

2. Convert RGB into HSI model   (1)

3. Explain sampling and quantization using a neat sketch.   (3)

4. A point $P(5, 1)$ is rotated by $90°$ about a pivot point $(2, 2)$. What is the coordinate of the new transformed point P'?   (2)

5. Why is transformation applied to the image? Explain the Discrete Fourier transformation with the necessary formulas.   (3)

6. Find the Haar transform of the signal $f(m, n) = \begin{bmatrix} 5 & -3 \\ 3 & 1 \end{bmatrix}$ (2)

7. Perform Histogram equalization for the given image. Draw the histogram of the image before and after equalization

$$\begin{matrix} 1 & 6 & 2 & 4 \\ 3 & 1 & 2 & 2 \\ 4 & 2 & 3 & 5 \\ 2 & 3 & 1 & 2 \end{matrix}$$

(4)

8. Apply weighted average filter to the pixel indicated by (*) using a 3 x 3 neighborhood   (2)

$$\begin{matrix} 3 & 9 & 11 & 2 \\ 7 & 15^* & 8 & 8 \\ 10 & 12 & 9 & 10 \\ 1 & 9 & 11 & 12 \end{matrix} \qquad \begin{matrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{matrix}$$

...... *All the Best* ......

17/10/24   TIME: 60 Mins   Max: 20 marks

ANSWER ALL THE QUESTIONS

1. The arithmetic decoding process is the reverse of the encoding procedure. Decode the message 0.23355 given the coding model.   (4)

Symbol	probability
a	0.2
e	0.3
i	0.1
o	0.2
u	0.1
!	0.1

2. For the given 8-bit image perform LZW coding and find the encoded output.   (4)

39	39	126	126
39	39	126	126
39	39	126	126
39	39	126	126

3. Explain the image degradation and restoration process in detail.   (2)

4. Apply a 3x3 median filter to the following pixel values of a noisy image patch:

$$\begin{bmatrix} 150 & 200 & 50 \\ 60 & 255 & 45 \\ 70 & 190 & 80 \end{bmatrix}$$

What is the output value for the centre pixel after applying the median filter? (2)

5. Briefly explain noise models with neat sketches   (4)

6. Explain various Lowpass and Highpass frequency domain filters used for image smoothing.   (4)

....All the Best....

Date: 21-11-24   Duration: 3 Hrs   Mark: 50 marks

ANSWER ALL THE QUESTIONS

1. a) Consider the two image subsets S1 and S2 in the following figure. Assume that V = {1}, determine whether these two subsets are (3)

    (1) 4-adjacent.
    (2) 8-adjacent
    (3) m-adjacent

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              S₁                        S₂
   0   0   0   0   0 | 0   0   1   1 | 0
   1   0   0   1   0 | 0   1   0   0 | 1
   1   0   0   1   0 | 1   1   0   0 | 0
   0   0   1   1   1 | 0   0   0   0 | 0
   0   0   1   1   1   0   0   1   1   1
```

  b) Write short notes on (i) luminance (ii) brightness (iii) hue (iv) saturation   (2)

  c) Compute 2D-DCT for the 4 X 4 image f(m,n) shown below using kernel method   (4)

$$f(m,n) = \begin{matrix} 1 & 2 & 3 & 4 \\ 5 & 3 & 2 & 2 \\ 1 & 2 & 3 & 4 \\ 5 & 3 & 2 & 2 \end{matrix}$$

d) Write down the DFT pair of 8 X 16 digital image.   (1)

2. a) Write a short note on unsharp masking and high boost filtering. Point out the steps involved in unsharp filtering using a neat sketch.   (3)

b) Discuss spatial filtering in image processing. What are the differences between linear and non-linear filters (mention filter names in both cases)   (2)

c) In an application, an averaging mask is applied to input images to reduce noise, and then a Laplacian mask is applied to enhance small details. Would the result be the same if the order of these operations were reversed? Justify your answer with an example.   (2)

d) Consider an image that has 3 bits/pixel(the possible range of values is 0 to 7).   (3)
The following histogram information of the image is provided as below

Gray-level value	0	1	2	3	4	5	6	7
No. of Pixel Histogram Value	10	8	9	2	14	1	5	2

By using Histogram eq. process, enhance the above image.
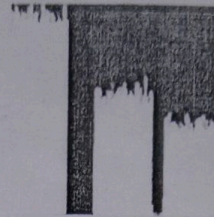
3. a) Identify the type of noise present in the following plots. (4)
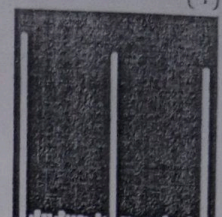

(a)   (b)   (c)   (d)

b) Explain the following regarding the contra-harmonic filter
   i) When Q is positive   ii) When Q is negative
   What kind of noise is eliminated in these cases? Justify your answer (3)

c) Perform Geometric mean, Harmonic mean and Alpha - trimmed mean filter(Assume d= 2), for the given image, with pixel values ranging from 0 to 255: (3)

30	10	20
10	250	25
20	25	30

4. a) Compute the degree of compression that can be achieved using Huffman coding and Run length encoding(horizontal and vertical) for the given image. (4)

1	1	1	2
2	1	1	1
3	2	2	2
2	3	3	3

b) Explain the process involved in image compression with a block diagram. (3)

c) Compute Mean Square Error(MSE) and signal to noise ratio for the image given in 4.a. (3)

5. a) Apply a thresholding technique where the threshold value is 128. What is the resulting image after thresholding? Calculate the percentage of white pixels in the matrix. (3)

120	130	80	150
90	140	200	70
180	110	60	250
130	110	170	90

b) What are the filter masks for: (a)Point Detection (b) Horizontal line detection (c) 45° diagonal line detection (d) Vertical edge Sobel detection. (4)

c) Explain the Otsu thresholding algorithm with the necessary steps (3)

------ All the Best------

End Semester Examination – NOV 2024
CSPE73 – Natural Language Processing (Elective)

Class / Semester : IV CSE / VII   Time   : 9.30 AM to 12.30 PM
Date   : 20.11.2024   Marks : 30   Section : A

Answer all questions

1. Draw the pronunciation networks for the word **"Wonderful"** using Markov model and Hidden Markov Model.   [CO3]   (5)

2. Perform the Word Sense Disambiguation using Selection Restriction approach for the following pairs of sentences by identifying the corresponding restriction words.   [CO4]   (5)
   a. Jack saw a duck on the rod.
       A duck is floating on the pool.

   b. Ram read a passage from the newspaper.
       Is there any passage to cross the road?

   c. Let me skim over your composition to make sure there are no typos.
       Let skim the milk and then prepare a cup of coffee.

3. Consider the CNF grammar G defined for a language L.   [CO2]   (10)

    S   → AB | BC
    A   → BA | a
    B   → CC | b
    C   → AB | a

    Check whether the string **aaba € L(G)** or not using **CYK** parsing.

4. Apply the Hobb's Algorithm to perform Anaphora Resolution for the following text.   [CO4] (5)

    Emily has a Cat. She loves it.

5. Exlpain in detail about the various steps involved in a typical Sentiment Analysis with an example.   [CO5] (5)