**Cairo University**
**Faculty of Computers and Artificial Intelligence**
**--*-Mid-Term Exam**

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|---|---|
| **Department: Information Technology** | |
| **Course Name: Pattern Recognition** | **Date: April 2022** |
| **Course Code: IT** | **Duration: 1 hour** |
| **Instructor(s): Dr. Mona Soliman** | **Total Marks: 15 Marks** |
| **Name :……..……SID:…….** | |

| |
|---|
| **15** |

## Question-1

### a. Complete the following: (4 marks)

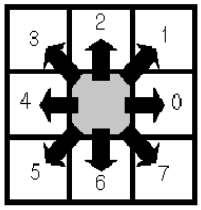
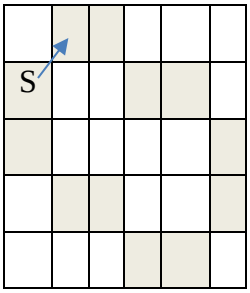
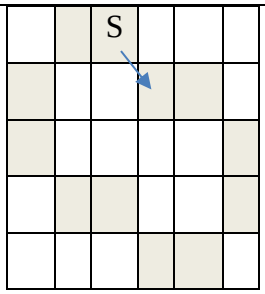
1- PCA is a dimensionality reduction algorithm started with a matrix of …….. features and end-up with a matrix of …… features

2- DFT can be used to describe ……. information of the object. The resulting feature vector is consisting of …….

3- The DBSCAN algorithm uses two main parameters:……. , and …….

4. The main problem with the first-order statistical texture is …….

b. For the following two shapes a, and b with starting point indicated as **S**, get the following: (3 marks)

| | | |
|---|---|---|
|  |  (a) |  (b) |
| (i) Stander Chain Code | | |
| (ii) minimum circular shift chain code | | |

iii. Is the minimum circular shift chain code for shapes (a) and (b) the same?? Why??

**Question-2 (3 marks)**
**For the following image**

| | |
|---|---|
| Mean | $\sum_{i} \boldsymbol{x_i p(x_i)}$ |
| Uniformity | $\sum_{i=0}^{n-1} (p(x_i))^2$ |

| | | | | |
|---|---|---|---|---|
| 2 | 3 | 4 | 4 | 6 |
| 1 | 2 | 4 | 5 | 6 |
| 1 | 1 | 5 | 6 | 6 |
| 0 | 1 | 3 | 3 | 4 |
| 0 | 1 | 2 | 3 | 4 |

**(i) Compute image histogram**

**(ii) Design a feature vector of 2D using mean and uniformity features**

**(iii) What is the class of this image using the following training samples**

| Sample | M | U | Class |
|---|---|---|---|
| 1 | 4 | 0.12 | 1 |
| 2 | 6 | 0.23 | 2 |
| 3 | 2.5 | 0.17 | 3 |

**Question-3 (5 marks)**

**(i) Complete the following table using the first iteration of the k-means algorithm (k=3) starting with the initial points highlighted in the table (Hint: use absolute distance as a distance measure)**

**Iteration-1**

| **Point** | | **Mean-1: (2,10)** | **Mean-2: (5,8)** | **Mean-3: (1,2)** | |
|---|---|---|---|---|---|
| | | **Dist mean-1** | **Dist mean-2** | **Dist mean-3** | **Cluster #**<br>**(Hint: What is the cluster of each point?)** |
| **A1** | **(2,10)** | | | | |
| **A2** | **(2,5)** | | | | |
| **A3** | **(8,4)** | | | | |
| **A4** | **(5,8)** | | | | |
| **A5** | **(7,5)** | | | | |
| **A6** | **(1,2)** | | | | |

**(ii) The output means of Iteration-1**

| **Cluster #** | **Cluster-1** | **Cluster-2** | **Cluster-3** |
|---|---|---|---|
| **New mean** | | | |

**(iii) plot the samples points with updated centers on x-y plane**