Jahangirnagar University
Department of Computer Science and Engineering
Fourth Year First Semester B.Sc. (Hons.) Final Examination -2022

Course Title: Wireless Network
Course No: **CSE-407**
Full Marks: 60
Time: 3 Hrs.

[Answer each of the following questions. Each question carries equal marks. Figures in the right margin indicate marks.]

1. Answer **all** questions:
   a) Define cell cluster. Show it with appropriate diagram. 2
   b) Compare adjacent and co-channel interference in WAN. 2
   c) Give two reasons of handover failure. 2
   d) Mention the main problem of infrared LAN. How optical signal is conveyed in infrared LAN? 2
   e) Compare SCO and ACL of PAN? 2
   f) Write the services are integrated under METIS in 5G networks. 2

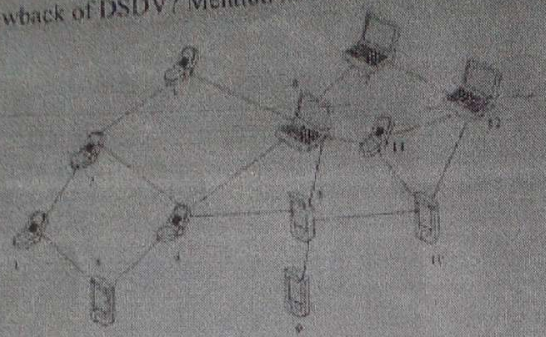
2. Answer **Any Three** out of **Four** questions:
   a) (i) Why hexagonal cell is used in WAN? Why sectored antenna is preferable for the network of congested area? 2
   (ii) Compare handover and roaming. 2
   b) (i) Draw the layered architecture of Wi-Fi protocol and compare it with OSI model. 2
   (ii) Draw the frame format of IEEE 802.11. Mention the function of type, subtype and more fragment field. 2
   c) Explain the femtocell deployment, OFDMA based physical layer, and MIMO of LTE. 4
   d) (i) Draw the complete diagram of a wireless sensor node and mention the function of sensing unit, processing and memory unit. 2
   (ii) How energy consumption model in WSN is modified with inclusion of data rate and number of hops. 2

3. Answer **Any Three** out of **Four** questions:
   a) How the routing table of nodes is updated under DSDV protocol? Give three examples of routing table update. 4
   b) Explain the benefit of Adaptive Modulation and Coding scheme in WiMAX. How S-GW and MME operates in collaboration in initial call setup under LTE-A? 4
   c) Why cooperative Spectrum Sensing is used in CRN? Show its arrangement with explanation? 4

d) Explain the basic concept of CDMA spread spectrum with diagram and also write the reason of using CDMA in wireless network. 4

4. Answer **Any Three** out of **Four** questions:

a) Draw the routing table of node 1 and 11 of the following ad-hoc network. What is the main drawback of DSDV? Mention its remedial measure. 4



b) Draw the Physical Resource Blocks (PRB) under both Normal and Extended CP of LTE-A. If the subcarrier separation is 15 KHz then determine the length of the slot of PRB for both the cases. 4

c) What will be the main hurdle of Bangladesh in implementing the 5G network? Why millimeter wave is used in 5G network? What are its main drawbacks? 4

d) Give three real-life applications of M2M in 5G? Compare remote, local and hybrid cloud in 5G network? 4

5. Answer **Any Two** out of **Three** questions:

a) A city has total population of 4×10^6. A mobile cellular service provider has 1200 cells with 12 channels each to serve the people. On an average each user generates 1 call/hour with duration of 2 minutes. Determine market penetration of the service provider. Given the GoS (grade of service) of the network is 5%. 6

Erlang B Traffic Table

Maximum Offered Load Versus B and N
B is in %

N/B	2	5	10	15
11	5.842	7.076	8.487	9.691
12	6.615	7.950	9.474	10.78
13	7.402	8.835	10.47	11.87
14	8.200	9.730	11.47	12.97
15	9.010	10.63	12.48	14.07

b) Each slot contains either six or seven OFDM symbols, depending on the Cyclic Prefix (CP) length. In LTE-A the separation between subcarrier Δf =15KHz. Now calculate the duration of a slot for both Normal CP and Extended CP. 6

c) If the number of nodes $N = 80$ and the number of CH is 5 then find, 6

$$T(n) = \begin{cases} \frac{p}{1-p(r \bmod (1/p))} & for\ n \in G \\ 0 & otherwise \end{cases}$$

for $r = 0$ (1st round) and 1 (2nd round) for LEACH Clustering Protocol. If the local random number generated by ith node on round-1 is 0.0854 and that of on round-2 is 0.0356 then find its status (member or CH).

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Fourth Year First Semester B.Sc. (Hons.) Final Examination -2022

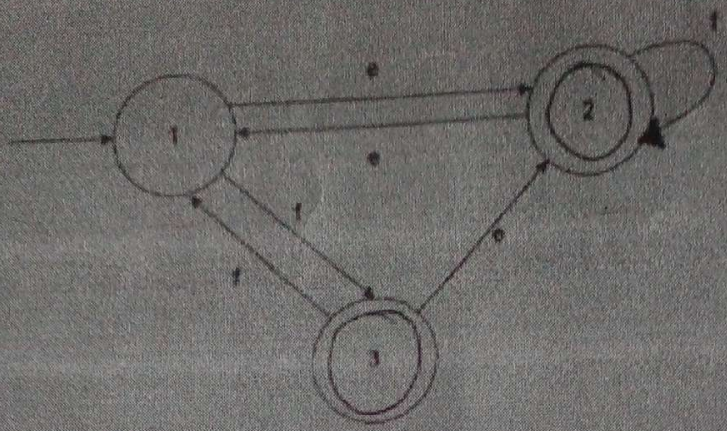
Course Title: Theory of Computation and Compiler Design
Course No: CSE-401
Time: 3 Hrs.
Full Marks: 60

[Answer each of the following questions. Each question carries equal marks. Figures in the right margin indicate marks.]

1. Answer all questions:
   a) Define theory of computation. 2
   b) Differentiate between DFA and NFA. 2
   c) Define pumping lemma for context free languages. 2
   d) Compare compiler and interpreter. 2
   e) Define just-in-time compiler? 2
   f) What is sentinels? 2

2. Answer **Any Three** out of **Four** questions:
   a) Convert the regular expression $(a \cup b)^* aba$ to an NFA. 4
   b) Prove that, if a push down automata recognize some language, then it is context free. 4
   c) Prove that every multi tape Turing machine has an equivalent single tape Turing machine. 4
   d) Discuss how finite automata is used to represent tokens and perform lexical analysis with examples. 4

3. Answer **Any Three** out of **Four** questions:
   a) Prove that the push down automaton (PDA) M_1 that recognizes $\{ a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i=j \text{ or } i=k \}$ with state diagram. 4
   b) Describe a turning machine (TM) M_1 that decides $A = \{ 0^{2^n} \mid n \geq 0 \}$ the language consisting of all strings of 0s whose length is a power of 2, also give the state diagram for TM (M_1). 4
   c) Describe in detail the HILBERT'S Problem, also discuss about Church Turing Thesis. 4
   d) A three state DFA is given below, convert it to an equivalent regular expression. 4



4. Answer **Any Three** out of **Four** questions: 4

a) Illustrate the basic blocks in compiler design and discuss about the implementation of symbol table.

b) Explain the role of intermediate representation of translating to intermediate code generation. 4

c) Describe the typical stages of in converting a DFA to a regular expression. 4

d) Explain in detail the issues consider while designing code generation. 4

5. Answer **Any Two** out of **Three** questions: 6

a) Write the proof idea that "Any context free language is generated by a context free grammar in Chomsky normal form".

Convert the following CFG G_1 in Chomsky normal form

$S \rightarrow ASA \mid aB$

$A \rightarrow B \mid S$

$B \rightarrow b \mid \varepsilon$

b) A Turing machine with stay put instead of left is similar to an ordinary Turing machine, but the transition function has the form, 6

$\delta: Q \times \Gamma \rightarrow Q \times \Gamma \times (R, S)$

At each point, the machine can move its head right or left it stay in the same position. Show that this Turing machine variant is not equivalent to the ordinary version. What class of languages do these machines recognize?

c) Explain in detail: 6

i. The activation tree in runtime environment

ii. Peephole optimization

iii. Shift reduce parser

Jahangirnagar University
Department of Computer Science and Engineering
Fourth Year First Semester B.Sc. (Hons.) Final Examination 2022

Course Title: Digital Image Processing
Full Marks: 60

Course No: **CSE-405**
Time: 3 Hrs.

[Answer each of the following questions. Each question carries equal marks. Figures in the right margin indicate marks.]

1. Answer **all** questions:
   a) Define (*any two*): i) Image processing ii) Noise (in image) iii) Zero crossings iv) Wavelet — 2
   b) How can we differentiate between illumination and reflectance? — 2
   c) Sketch the match band effect. — 2
   d) State some of the applications of digital image processing in different fields. — 2
   e) Define (*any two*): i) Color map ii) FFT iii) Bit-plane iv) Discrete Laplacian — 2
   f) What is image histogram? — 2

2. Answer **Any Three** out of **Four** questions:
   a) Explain SURF/SIFT image feature descriptor. — 4
   b) Describe different energy sources used in creating images. — 4
   c) Discuss the reasons for the importance of Gaussian filters. — 4
   d) Explain the relation between RGB, HSV, CMYK and YCbCr. — 4

3. Answer **Any Three** out of **Four** questions:
   a) Write a complete Python/MATLAB program to perform (*any ONE*): — 4
      i) Histogram of a color (RGB) image
      ii) Average filtering of a gray scale image
      iii) Cleaning salt and pepper noise from a noisy grayscale image using median filtering.
   b) i) Differentiate between brightness and contrast. — 4
      ii) Explain the convolution property in 2D fourier transform.
   c) i) Differentiate linear filter and non-linear filter. — 4
      ii) State the importance of hue and saturation in the formation of color image.
   d) Construct a model of image degradation. — 4

4. Answer **Any Three** out of **Four** questions:
   a) Classify image compression methods and explain Huffman coding with an example. — 4

c) Explain *ROI (region of interest) filtering* in detail. 4

d) Distinguish among 2-D moment, central moment, and normalized central moment of order (p+q). 4

e) Discuss the trade-offs between various filtering techniques in terms of i) noise reduction ii) detail preservation 4

5. Answer **Any Two** out of **Three** questions:

a) Compare between single and double thresholding method for image segmentation and summarize the applications of thresholding. 6

b) Summarize the steps to evaluate principal compopent analysis (PCA) of a given dataset. 6

c) Write a complete Python/MATLAB program that reads a color (RGB) image and then performs edge detection on this image. 6

Jahangirnagar University
Department of Computer Science and Engineering
Fourth Year First Semester B.Sc. (Hons.) Final Examination 2022

Course Title: Software Engineering and Information System Design
Full Marks: 60

Course No: CSE-403
Time: 3 Hours

[Answer each of the following questions. Each question carries equal marks. Figures in the right margin indicate marks.]

1. Answer all questions:
   a) Define the terms: i) Software design ii) Verification. 2
   b) What are the phases of the Waterfall software development model? Describe the specification of System requirements analysis and definition phase for developing an automated Banking system. 2
   c) Define use case with examples of using <include> and <extension>. 2
   d) What are the goals of software design? Define different approaches to verify the correctness of software design. 2
   e) Label different type of testing from functional, code, knowledge and release perspective. 2
   f) Define integration testing. Draw a diagram to represent the testing order of the modules M_1 ... M_6 in breadth-first approach using top-down integration testing. 2

2. Answer **Any Four** out of **Five** questions:
   a) Explain requirements analysis process. Give an example of functional requirements specification. 3
   b) Why Unified process model is developed? Describe Unified process model for software development with diagram. 3
   c) Classify different types of design. Show that each element of the analysis model is directly traceable to parts of design model using a diagram. 3
   d) You want to set up a small LAN game center. By considering roles and responsibilities, list the different types of users that need to be considered. Also mention the roles and responsibilities briefly that you considered. 3
   e) Explain the main focus of Unit testing including the Unit test procedure. 3

3. Answer **Any Three** out of **Four** questions:
   a) Apply the phases of incremental development model to a specific software project. Consider the development of a Word processing software. Prepare a list of output of each increment after it is applied to the system to be developed. 4
   b) Write down the coding principles to guide the coding task. Construct the template code in C# or Java programming language for the following ATM system by identifying the classes using the class identification rules sketching an UML class diagram. 4

Consider the automation of the ATM services of a Bank for its customers. Each customer may have Savings and Current accounts. To withdraw money from an ATM machine, the account holder first inserts his ATM card to the card insertion slot. Then the customer waits for the message to allow him to input the PIN number. If it is successfully entered, he input the amount

to be withdrawn. If the account has enough balance, the ATM machine disburses the money note. If no further transaction is requested, the ATM card is thrown out of the slot.

c) Explain concurrent activities of activity diagram. Prepare an activity diagram for Stock trade processing system. At first, the system verifies each order, and then execute the order. If successful, a confirmation is sent, the account is debited and the related updates are performed. In failure, a failure notice is sent. Finally, the order is closed. 4

d) i) Illustrate architectural design. Sketch the architectural context diagram. 4
ii) Explain formal specification. Write the solution to prove that a program behavior fits its specification.

4. Answer **Any Three** out of **Four** questions:

a) i) Compare the performance of different methods of computing the cyclomatic complexity of a program or algorithm. 4
ii) Illustrate flow graph showing its different constructs.

b) Find the **Cyclomatic Complexity** of the following code segment and show 4 different basic paths (if exists) for test cases: 4

```
int average (int[ ] value, int min, int max, int N) {

    int i, totalValid, sum, mean;
    i = totalValid = sum = 0;

    while ( i < N || value[i] != -999 ) {
        if (value[i] >= min && value[i] <= max){
            totalValid += 1; sum += value[i];
          if (totalValid > 0)
            mean = sum / totalValid;
          else
            mean = -999;
        }

        i += 1;
    }

    return mean;
}
```

c) Classify different fact analysis tools. Organize a Data Flow Diagram (DFD) for Level 0 and Level 1 to show the data flow and transformation of a Course registration system. 4

d) i) Differentiate between generalization and specialization with example 4
ii) Explain different types of system testing.

5. Answer **Any Two** out of **Three** questions:

a) Justify the use of delegation in design patterns. 6
Consider an example of a local Bank office employing Principle Officer who obtain the position of SPO with 20% increase in salary after few years, and AGM get 40% increase in salary when they are more experienced.

Recommend the use of i) specialization, ii) delegation and iii) specialization, delegation and an interface design pattern in designing the above system with appropriate class combination

employing inheritance and implementation with code template.

b) Consider the following scenario: 6

Suppose we want to develop a web-based social network with the following functionalities:

i. The user should signup the system.
ii. The user should log into the system
iii. The user can send or accept the friend request.

We need to convert this system into separate components; Component 1: Sign up and log in; Component 2: Send Friend request; Component 3: Accept friend request. Now, when we start our activities, then we can start with component 1(signup and login). This component undergoes the phases of requirements gathering and analysis, design, implementation, deployment, and maintenance. When this component is ready, we deliver this one component to the customer.

After that, we add component 2 that sends the friend request. This component undergoes the phases of requirements gathering and analysis, design, implementation, deployment, and maintenance. When this component is ready, we deliver this one component to the customer.

Finally, we add component 3 that accepts a friend request. This component undergoes the phases of requirements gathering and analysis, design, implementation, deployment, and maintenance. When this component is ready, we deliver this one component to the customer.

(i) Which one of the Software Process Models discussed in lectures would you choose to develop the software for the proposed system in the Case Study? Give two (2) reasons for your choice.

(ii) Which one of the Software Process Models discussed in lectures would you **NOT** choose to develop the software for the proposed system in the Case Study? Give two (2) reasons for your choice.

c) i) Predict Function points using the empirical relationship based on countable measures and complexity of software. 6

ii) Summarize the main features of integration testing based on the statement that you doubt that they will work when we put all unit tested modules together.

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Department of Computer Science and Engineering

1. Define cell and cell cluster. Give the design steps of WAN. CO1
2. Determine frequency reuse distance of 7-cell pattern. How cell cluster balances interface and traffic capacity? CO2
3. A city has a population of 10×10^6. A mobile cellular service provider has 1500 cells with 15 channels each to serve the people. On an average each user generates 1 call/hour with duration of 2 minutes. Determine market penetration of the service provider. Given the GoS (grade of service) of the network is 2%. How much improvement of market penetration will be achieved with increment of two channels/cell? CO5

9.010

5+5+10 = 20

6. Define each type of design. Show how each element of the analysis model is translated to the corresponding element of the design model.

Jahangirnagar University

Department of Computer Science and Engineering

Tutorial Examination, 4th Year 1st Semester B.Sc. (Hons.) 2021-2022

[illegible] Marks: 5 × 6 = 30

1. Draw the complete diagram of a sensing node of WSN. Mention the function of 'sensing unit' and 'processing and memory unit'.
2. Give three basic requirements to be satisfied by clustering protocol. What are the limitations of LEACH algorithm? Mention the steps of deep clustering algorithm.
3. If the number of nodes $N = 120$ and the number of CH is 6 then find central random number $T(n)$ for $r = 0$ (1st round) and $r = 1$ (2nd round). If the random number generated by ith sensor node is 0.0012 and that of jth node is 0.156 then give the decision about the nodes against 1st and 2nd round.

4. [illegible] system.
5. What is data modeling? Give an example of data modeling for course registration system.

6. [illegible] information system of the Hospital.
7. Define each type of design. Show how each element of the analysis model is translated to the corresponding element of the design model.

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1. Explain Femtocell Deployment of LTE Network. What is the benefit of MIMO in LTE?
2. Draw the complete architecture of LTE Network. What is the function of combination of S-GW and MME in LTE?
3. Draw LTE frame structure and physical resource block. Evaluate the duration of a time slot for both normal CP and extended CP. What is the main benefit of CP in signal detection?

6+6+8=20

Determine market penetration of the system if 2%. How much improvement of market penetration will be achieved with increment of two channels/cell? CO5

5+5+10 = 20

What is data modeling? Give an example of data modeling for course registration system.

Class diag... information system of the Hospital.

6. Define each type of design. Show how each element of the analysis model is translated to the corresponding element of the design model.

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Department of Computer Science and Engineering

Tutorial Examination, 4th Year 1st Semester B.Sc. (Hons.) 2021-2022

CSE-403: Software Engineering and Information System Design Marks: $5 \times 6 = 30$

1. Define Software and its components. What is software engineering?
2. Explain that software engineering is a layered technology. What is object-oriented analysis?
3. Define UML and give some examples of UML analysis and design tools. Sketch a UML class diagram for ***event*** management.
4. Explain requirements analysis process. Give an example of functional requirements specification.
5. Explain use case with <include> and <extension>. Draw a Use case diagram for library management system.
6. What is data modeling? Give an example of data modeling for course registration system.

[illegible] information system of the Hospital.

6. Define each type of design. Show how each element of the analysis model is translated to the corresponding element of the design model.

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Department of Computer Science and Engineering

Tutorial Examination, 4th Year 1st Semester B.Sc. (Hons.) 2021-2022

CSE-403: Software Engineering and Information System Design Marks: $5 \times 6 = 30$

1. What are the different software development models? Describe iterative software development model.
2. What are the phases of the Waterfall software development model? Define the specification of System requirements analysis and definition phase for developing a Library system.
3. Explain risk assessment and reduction. How the problem of sub-system integration is resolved in spiral model?
4. Draw the diagram of the incremental model. Differentiate between iterative and incremental model.
5. In a hospital, a patient is admitted under the care of a team of doctors and nurses. The patient has to be admitted under a ward. A file is allocated to each bed of the patient to keep records of the doctor's advice and medicine for the proper treatment of the patient until he is released from the hospital. Construct the template code in C# or Java programming language for the classes after drawing the UML class diagram of the above Patient information system of the Hospital.
6. Define each type of design. Show how each element of the analysis model is translated to the corresponding element of the design model.

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Tutorial Examination, 4th Year 1st Semester B.Sc. (Hons.) 2021-2022

CSE-403: Software Engineering and Information System Design Marks: 30

1. Define architectural design. Write down the activities of architectural design.
2. What are the objectives of class design? Show the class design details of Library system identifying the required classes with the attributes, operations, visibilities and class relationships in UML notation.
3. Describe MVC architecture.
4. Explain Unit test procedure in brief.
5. Illustrate top-down integration testing in breadth-first approach.

b. Sketch the UML diagram

a. Class diagram with inheritance

Class diagram with polymorphis

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4th Year 1st Semester B.Sc. (Hons.) Tutorial Examination 2021-2022

Course Code: CSE 404 Course Title: Software Engineering and ISD Lab

4. Describe the System Specification of your project based on the following:
   d. List of sub-systems and end users
   e. User interface : Dash board, Entry Forms and Reports (any 2)
   f. Network diagram

5. Specify Requirements analysis:
   a. Use case modeling with <include> and <extension> for data entry sub-system (any 2)
   b. Use case modeling with <include> and <extension> for ~~data entry~~ reporting sub-system (any 2)
   c. Data flow modeling for any 2 subsystems (any 2) up to Level-0 and Level-1

6. Sketch the UML diagrams:
   a. Class diagram with inheritance

   Class diagram with polymorphis

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4th Year 1st Semester B.Sc. (Hons.) Tutorial Examination 2021-2022

Course Code: CSE 404

Course Title: Software Engineering and ISD Lab

1. What does activity diagram represent? Draw activity diagrams for your project.
   Answer the following:
   a. Clarify whether all of these activities are required?
   b. Give a schedule of time length in month for enough manpower for completion of this project.
   c. List of tools required.

2. Which development model you prefer for your project and why?
   Answer the following:
   a. Apply incremental model to your project if applicable or any other model, and show project progress using diagrams.
   b. List the output of each increment.
   c. Specify sample output of each increment with mentioning the steps (at least 2 output for each increment).

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Department of Computer Science and Engineering

4th Year 1st Semester B.Sc. (Hons.) Tutorial Examination -2022

Course Title: ***Digital Image Processing*** Full Marks: **30** Course No: **CSE-405**

Time: **1 hour** Tutorial: **#1**

[Answer each of the following questions. Each question carries equal marks. Figures in the right margin indicate marks.]

1. (a) Define: (i) Digital Image (ii) Mask (iii) Separable filter 3
   (b) List the names of six different image file formats. 3

2. (a) Explain the concept of image histogram equalization? 3
   (b) Describe different energy sources used in creating images. 3

3. Demonstrate the process of filtering of an image using a mask. 6

4. Compare *unsharp masking* and *high-boost filtering*. 6

5. Evaluate the importance of Gaussian filtering. 6

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Jahangirnagar University
Department of Computer Science and Engineering
4th Year 1st Semester B.Sc. (Hons.) Tutorial Examination -2022

Course Title: ***Digital Image Processing*** Full Marks: **30** Course No: **CSE-405**
Time: **1 hour** Tutorial: **#2**

[Answer each of the following questions. Each question carries equal marks. Figures in the right margin indicate marks.]

1. Define: i) noise (in image) ii) entropy (in image) iii) FFT 6

2. Write the names of different (*at least three*) types of noises present in images and corresponding filters for cleaning those noises. 6

3. Construct a model of image degradation. 6

4. Compare *Huffman coding* and *Run length encoding*. 6

5. Compose a *Python* code to find the DFT of a grayscale image photo.tiff . 6

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Jahangirnagar University
Department of Computer Science and Engineering
4th Year 1st Semester B.Sc. (Hons.) Tutorial Examination -2022

Course Title: ***Digital Image Processing*** Full Marks: **30** Course No: **CSE-405**
Time: **1 hour** Tutorial: **#3**

[Answer each of the following questions. Each question carries equal marks. Figures in the right margin indicate marks.]

1. Define: i) zero crossings) ii) discrete Laplacian iii) Wavelet iv) Morphological structuring element — 6
   (iv) Morp operation

2. (a) Write the differences between *single thresholding* and *double thresholding*. — 3
   (b) Discuss the applications of thresholding. — 3

3. Explain HSV color model *and* the conversion between RGB and HSV. — 3+3=6

4. Distinguish among *2-D moment, central moment,* and *normalized central moment of order (p+q).* — 6

5. Compare Prewitt, Roberts cross-gradient, and Sobel filters in detail. — 6

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Write the equations for four affine moment invariants

matlab progsam of dilation