Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science and Engineering
4th Year 2nd Semester B.Sc. Engineering Final Examination-2017

Course Title: Cryptography and Network Security **Course Code: CSE462**
Total Marks: 60 **Time: 3 (three) Hours**

N.B. i) Answer **SIX** questions taking any **THREE** from each Section, ii) All questions are of equal values. iii) Use separate answer script for each section

SECTION-A

1. **(a)** Describe the three Dimensions of Security. What do you mean by Positive Hackers and Negative Hackers? **3**
   (b) Mention the Domains of Network Security. **2**
   (c) Explain the Basic pixel reference errors (BPRE) Scheme. **5**

2. **(a)** Describe the Network and Documents Supporting Security Policies. **2**
   (b) Let A wants to communicate with B. They are given two public numbers n=47 and g=3. Let A's secret key is x=8 and B's secret key is y=10. Establish a shared secret key between A and B using Diffie-Hellman key exchange algorithm. **6**
   (c) Describe the Network Based IPS Implementation. **2**

3. **(a)** Depict the three major components to most worm attacks. **3**
   (b) Briefly explain the Attack Methodologies. **4**
   (c) Find out the cipher text of the plaintext "LIFEISFULLOFSUCCESS"using polyalphabetic ciphers where the keyword is "EARTH". **3**

4. **(a)** Write a standard ACL to block all traffic from 172.16.4.0/24 network, but allow all other traffic. **6**
   (b) Explain the Pattern-Based Detection of Signature Trigger. **2**
   (c) Describe the factors that impact IPS sensor selection and deployment. **2**

SECTION-B

5. **(a)** Write an extended ACL to block all FTP traffic from 172.16.4.0/24 network, but allow all other traffic. **5**
   (b) Classify the Coverage Problem. Describe the Coverage Configuration Protocol (CCP). **3**
   (c) Describe the Host Based IPS Implementation. **2**

6. **(a)** Depict the Intrusion Detection Systems (IDSs) and Intrusion Prevention Systems (IPSs). **4**
   (b) Explain the OSI Security Architecture. **3**
   (c) Describe the mutual authentication process of Smart Card with appropriate diagram. **3**

7. **(a)** You are given p= 3 and q= 11 and d= 9. Give the sender's and receiver's computations for the plaintext "PADMA" by using RSA algorithm. **5**
   (b) Explain the Signature Actions. **2**
   (c) Describe the embedding performance parameters. **3**

8. **(a)** Describe the Prediction error (PE) histogram scheme. **4**
   (b) Apply Hill Cipher where key is (ddcf) and suppose the plaintext message is HELP. Find out the Cipher text. **3**
   (c) Sketch the encryption and decryption scenarios for Cipher Block Chaining Mode. **3**

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Course Title: Digital Image Processing **Course Code: CSE452**
Full Marks: 60 **Time: 3(Three) Hours**

N.B.
i) Answer SIX questions, taking any THREE from each section,
ii) All questions are of equal values,
iii) Use separate answer script for each section.

SECTION-A

1. **(a)** Give an expression for 2D-forward and inverse discrete cosine transform and list its properties. 3
   (b) Develop Hadamard transform for n=3. Discuss the properties of the Hadamard transform. 3
   (c) Explain the smoothing of images in frequency domain using: 4
   I. Ideal lowpass filter
   II. Butterworth lowpass filter.

2. **(a)** With a suitable diagram, explain how an image is acquired using a circular sensor strip. 3
   (b) Define 4-adjacency, 8- adjacency and m- adjacency. 3
   (c) Consider an image segment: 4

	3	1	2	1	(q)
	2	2	0	2	
	1	2	1	1	
(p)	1	0	1	2	

   I. Let V= {0, 1, 2} compute the length of the shortest 4,8 and m path between p and q.
   II. Repeat for V={2, 3, 4}

3. **(a)** What are basis vectors? 2
   (b) Explain any four properties of two dimensional Fourier transforms. 2
   (c) For the given orthogonal matrix A and image U, obtain the transformed image and basis images. 6

$$A=\frac{1}{\sqrt{2}}\begin{bmatrix}1 & 1\\ 1 & -1\end{bmatrix} \quad U=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$$

4. **(a)** Given the two-bit image of size 5×5. Calculated the components of the histogram and the average value of intensities. 3
   (b) The Laplace is used for second order derivatives and the Gradient is used for first order derivatives for image sharpening. Explain with appropriate figure. 5
   (c) Difference between local and global histogram equalization. 2

SECTION-B

5. **(a)** Explain the following: 3

I. Gray-level slicing

II. Bit plane slicing

(b) For the given 4 × 4 image having grey scale between [0, 9], get histogram equalized image and draw the histogram of image before and after equalization. 4

2	3	3	2
4	2	4	3
3	2	3	5
2	4	2	4

(c) Briefly explain how arithmetic and logic operations are used for image enhancement. 3

6. **(a)** What are the necessary conditions to be satisfied to have Fourier transform (FT) representation of a given signal? 2

(b) Determine the FT of the following continuous time signal: 4

$$x(t) = \begin{cases} 1, & |t| < T/2 \\ 0, & otherwise \end{cases}$$

Plot the magnitude and phase spectrum.

(c) Ideal high pass filters are used for image sharpening and ideal low pass filters are used for image smoothing. Justify this. 4

7. **(a)** Briefly discuss the following: 4

I. RGB color model

II. HIS color model

(b) (RGB) = (0.683, 0.1608, 0.1922) convert this in to HIS model. 3

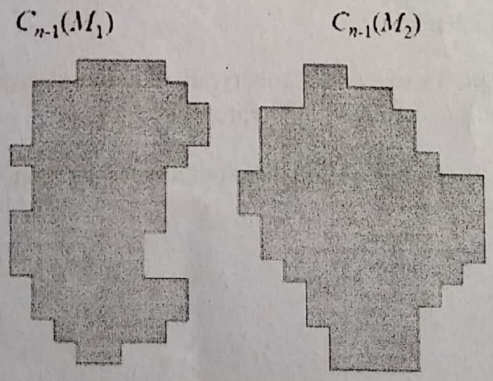
(c) Explain a general image compression system model with block diagram. 3

8. **(a)** Sketch a typical motion complements video encoder. 2

(b) Compute Golomb code $G_3(n)$ for $0 \leq n \leq 15$. 3

(c) Differentiate between edge-based segmentation and region based segmentation. 2

Explain Dam construction with following figure. 3



Bangabandhu Sheikh Mujibur Rahman Science and Technology University
Department of Computer Science & Engineering
4th Year 2nd Semester B.Sc. Engineering Final Examination-2017

Course Title: Machine Learning **Course Code: CSE 490**
Full Marks: 60 **Time: 3(Three) Hours**

N.B.
i) Answer SIX questions, taking any THREE from each section,
ii) All questions are of equal values,
iii) Use separate answer script for each section.

SECTION-A

1. (a) What is SVM? Why is SVM effective on high dimensional data? 2

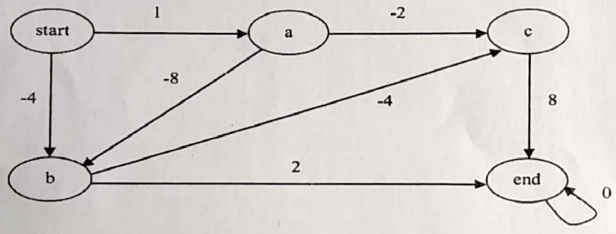
(b) Following is a data set that contains two attributes, X and Y , and two class labels, "+" and "-". Each attribute can take three different values: 0,1, or 2. The concept for the "+" class is Y=1 and the concept for the "-" class is X= 0 ∨ X=2. 8

X	Y	Number of Instances	
		+	-
0	0	0	100
1	0	0	0
2	0	0	100
0	1	10	100
1	1	10	0
2	1	10	100
0	2	0	100
1	2	0	0
2	2	0	100

I. Build a decision tree on the data set. Does the tree capture the "+" and "-" concept?
II. What are the accuracy, precision, recall, and F_1- measure of the decision tree? (Note that precision, recall, and F_1- measure are defined with respect to the "+" class).

2. (a) What do you understand by Bagging and Boosting? 2

(b) Consider the deterministic reinforcement environment drawn below (let $\gamma=0.5$). The numbers on the arcs indicate the immediate rewards. 8



Assume we use a Q table for this task and initialize all of its entries to the immediate rewards obtained from each state-action pair.

i. A learner follows the path *start* → *a* → *b* → *end*. Using one-step, regular *Q* learning, which entries in the *Q* table change? Show the calculations that produce the new *Q* table entries.
ii. Which of the learner's steps in Part *i* are exploration steps? Explain.

3. (a) Give an example of a dataset to which you could apply linear regression. State what the goal of applying linear regression to that dataset is, and make up a few numerical values for data points to make it clear what the data could look like. 3

(b) What is VC-dimension? Briefly explain PAC learning model. 3

(c) Calculate precision, recall and accuracy for the following table. 4

Actual Class\Predicted class	cancer = yes	cancer = no	Total
cancer = yes	**90**	**210**	300
cancer = no	**140**	**9560**	9700
Total	230	9770	10000

4. (a) Consider the following examples and the kernel function, K that counts the number of features fo which two examples have the same value.

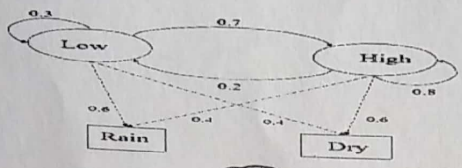
	F1	F2	F3	F4	Output
Ex1	T	F	F	F	T
Ex2	T	T	T	F	F
Ex3	F	F	F	F	T

I. What is the kernel matrix for this situation? Be sure to label and explain the axes.

II. Assuming that Ex2 and Ex3 turn out to be the only support vectors for this task, write down the learned decision function, using variables where insufficient information is provided. Be sure to explain your answer.

III. Explain how support vector machines can be viewed as following the minimal description-length principle.

(b) Calculate the probability of a sequence of observation, {'Dry','Rain'} where initial probability of two states are equal. **4**



B

5. (a) If Pr(response|trt)=0.50 and Pr(response|placebo)=0.25, then calculate OR(trt vs. placebo). **2**

(b) You are given m data points, Is it possible to train error converges to the true error as $m \rightarrow \infty$? If yes how? If not why? **3**

(c) Suppose you have the following training set with three Boolean input x, y and z, and a Boolean output U. Suppose you have to predict U using a naive Bayes classifier, **3**

x	y	z	U
1	0	0	0
0	1	1	0
0	0	1	0
1	0	0	1
0	0	1	1
0	1	0	1
1	1	0	1

I. After learning is complete what would be the predicted probability P (U = 0|x = 0, y = 1, z = 0)?

II. Using the probabilities obtained during the Bayes Classifier training, what would be the predicted probability P (U = 0|x = 0)?

(d) How a multi-layer neural network works? Explain with figure. **2**

6. (a) You have a dataset that involves four features. Feature D's values are in [0,100]. For the other three features, all of their possible values appear in this dataset. **4**

	A	*B*	*C*	*D*	*Category*
Ex1	T	X	F	75	true
Ex2	F	Y	T	20	false
Ex3	T	Z	T	10	true
Ex4	F	Y	T	35	false
Ex5	F	X	T	90	false
Ex6	T	Z	F	50	false

What are the three nearest-neighbors to Example 6? Explain. If this example was in the test set instead of the training set, would *k*-NN predict it correctly (using *k*=3)?

(b) What loss (objective) function should we use to judge the fit? **2**

(c) Suppose you have the following data with one real-value input variable & one real-value output variable. What is leave-one out cross validation mean square error in case of linear regression ($Y = bX+c$)? 4

X (Independent Variable)	Y(Dependent Variable)
0	2
2	2
3	1

7. (a) How does the perceptron learn its classification tasks? 2

(b) You will use the dataset below to learn a decision tree which predicts if people pass machine learning (Yes or No), based on their previous GPA (High, Medium, or Low) and whether or not they studied. 6

GPA	Studied	Passed
L	F	F
L	T	T
M	F	F
M	T	T
H	F	T
H	T	T

For this problem, you can write your answers using $\log_2$, but it may be helpful to note that $\log_2 3 \approx 1.6$.

I. What is the entropy H (Passed)?
II. What is the entropy H (Passed | GPA)?
III. What is the entropy H (Passed | Studied)?

(c) What is hidden markov model? Explain with example. 2

8. (a) How can you make a decision tree using gain ratio based on the following table 6

age	income	student	credit_rating	buys_computer
<=30	high	no	fair	no
<=30	high	no	excellent	no
31…40	high	no	fair	yes
>40	medium	no	fair	yes
>40	low	yes	fair	yes
>40	low	yes	excellent	no
31…40	low	yes	excellent	yes
<=30	medium	no	fair	no
<=30	low	yes	fair	yes
>40	medium	yes	fair	yes
<=30	medium	yes	excellent	yes
31…40	medium	no	excellent	yes
31…40	high	yes	fair	yes
>40	medium	no	excellent	no

(b) Compare attribute selection measures. 2

(c) Differentiate overfitting and tree pruning. 2

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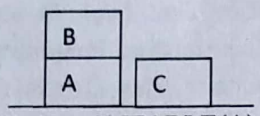
4th Year 2nd Semester B.Sc. Engineering Final Examination-2017

Course Title: Artificial Intelligence **Course Code: CSE 450**
Full Marks: 60 **Time: 03 (Three) hours**

N.B.
i) Answer **SIX** questions, taking any **THREE** from each section,
ii) All questions are of equal values,
iii) Use separate answer script for each section.

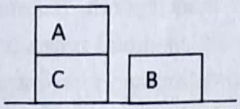
Section-A

1. **a)** Consider the following block world problem: 5



ON(B,A) ∧ ONTABLE(A) ∧ ONTABLE(C) ∧ ARMEMPTY

Initial state



ON(A,C) ∧ ONTABLE(C) ∧ ONTABLE(B)

Goal State

Figure-1(a): A simple blocks world problem

Now, show how STRIPS would solve this problem.

b) Consider a simple Bayesian Network, shown in Figure-1(b), where node A represents the season and can have four values: a1= winter, a2=spring, a3=summer and a4=autumn. Node B represents the area where the fish was caught: b1=Atlantic and b2=Pacific. Node X, which represents the type of the fish, has two possible values: x1=salmon and x2=sea bass. A and B are the parents of X. Similarly, the children of X represent lightness C, with c1=dark, c2=medium, and c3=light and width D, with d1=thick and d2=thin. Thus the season and the area determine directly what kind of fish is likely to be caught; the season and the area also determine the fish's lightness and width, but only indirectly through their effect on X. Assume that fishing boats go out throughout the year, and then the probability distribution on the variables of A is uniform and boats generally spend more time in Atlantic area than Pacific area. The other conditional probabilities are chosen in the similar manner. 5

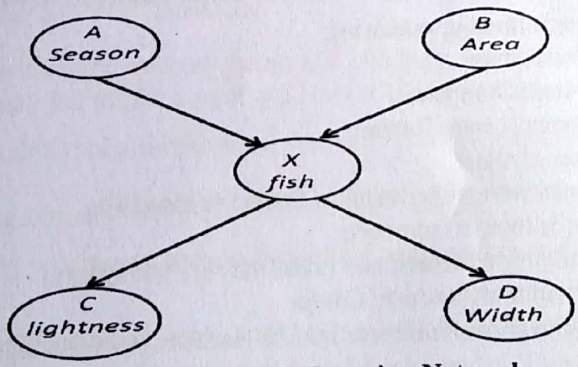


Figure-1(b): A simple Bayesian Network.

Now show all the necessary conditional probability tables for this network to find the probability for the following two cases:

i. The fish was caught in the summer in Atlantic area and is a sea bass that is dark and thin.
ii. The fish was caught in the summer in Pacific area and is a salmon that is light and thin.

2. a) Suppose a physician is considering a case of cholestatic jaundice, i.e., the development of a yellow hue to a patient's skin (jaundice) due to elevated blood levels of bilirubin (a pigment produced by the liver). This problem is caused by an inability of the liver to excrete bile normally, often due to a disease within the liver itself (intrahepatic cholestasis) or blockage of the bile ducts outside the liver (extrahepatic cholestasis). In a typical case of this type, the diagnostic hypothesis set might well include two types of intrahepatic cholestasis, hepatitis (Hep) and cirrhosis (Cirr), and two types of extrahepatic cholestasis, gallstones (Gall) and pancreatic cancer (Pan). In the D-S theory, this set of four disorders is called a frame of discernment, denoted Θ or {Hep, Cirr, Gall, Pan}. As noted earlier, the hypotheses in Θ are assumed mutually exclusive and exhaustive. Suppose that for a given patient, one observation supports intrahepatic cholestatic = {Hep, Cirr} to degree 0.6 ($m1$) whereas another disconfirms hepatitis (i.e., confirms {Cirr, Gall, Pan}) to degree 0.7 ($m2$). Find $Bel1 \oplus Bel2$ ({Hep, Cirr}) and $Bel1 \oplus Bel2$ ({Cirr, Gall, Pan}). If the third belief function ($m3$) for the same patient, corresponds to a new observation which confirms the diagnosis of hepatitis to the degree 0.8, then compute $m3 \oplus m4$, where $m4 = m1 \oplus m2$ 3

b) Explain the fuzzy set theory with example. 4

3. a) Consider the Hopfield network, shown in Figure-3(a). Suppose, initially all nodes are active. Now, convert this into any stable state.

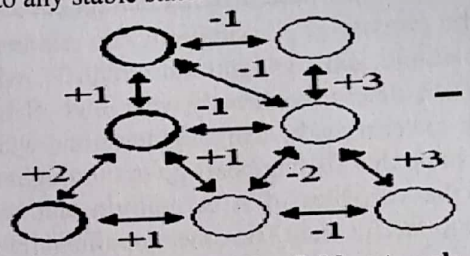


Figure-3(a): A simple Hopfield network 6

b) Consider the following sentences:
1. Marcus was a man
2. Marcus was a Pompeian
3. All Pompeian's were Roman
4. Caesar was a ruler
5. All Romans were either loyal to Caesar or hated him
6. Everyone is loyal to someone
7. People only try to assassinate rulers they are not loyal to
8. Marcus tried to assassinate Caesar

Converting the above sentences into "First order predicate logic".

4. a) Generate the decision tree for the following dataset by computing the impurity based on the transportation mode. 6

Gender	Car Ownership	Travel Cost	Income Level	Transportation Mode
Male	0	Cheap	Low	Bus
Male	1	Cheap	Medium	Bus
Female	1	Cheap	Medium	Train
Female	0	Cheap	Low	Bus
Male	1	Cheap	Medium	Bus
Male	0	Standard	Medium	Train
Female	2	Expensive	High	Car

b) Parse the following sentences by proposing appropriate CFG's: 4
i) Karim ekta boi porche.
ii) Duita sundar pakhi akashe urchilo.

Section-B

5. a) For each of the following agents develop a PEAS description of the task environment: 4
(Automated Taxi, Medical diagnosis system).

b) Evaluate the path A → I from the search graph given in figure-5(b) according to BFS. 3

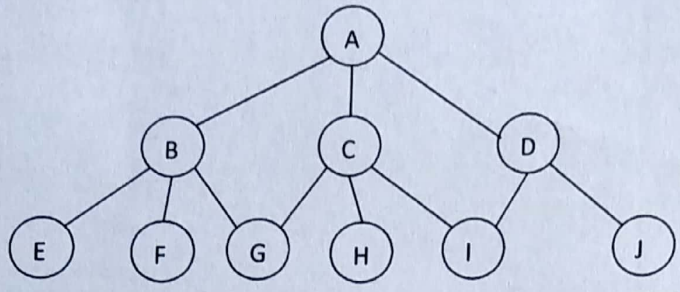


Figure-5(b)

c) What is the Alpha-Beta pruning? How does pruning improve the situation in game playing? 3

6. a) Compare between greedy best first search and A* search. 3

b) Convert the sentence $B_{1,1} <=> (P_{1,2} \vee P_{2,1})$ into CNF. 4

c) Suppose some axioms are given below: 3

P

$(P \wedge \neg Q) => R$

$(R \vee T) => Q$

$(X \vee Y) => T$

X

Now prove Q using resolution in propositional logic.

7. a) What is heuristic function? Write down the procedure to solve traveling salesman problem using "nearest neighbor heuristic" technique. 4

b) Write down the algorithm for steepest-ascent hill climbing. In what situations steepest-ascent hill climbing may fail to find a solution? How will you overcome such situations? 4

c) Percept sequence and action of a simple agent function for the Vacuum-cleaner world? 2

8. a) Write down the A* algorithm. Proof the optimality of A* search. 4

b) Write a LISP or Prolog program to convert Fahrenheit temperatures to Centigrade and vice versa. 3

c) Now-a-day, we are addicted to AI devices and we can't imagine a single day without the use of these devices. Moreover, AI devices changed our everyday life style. Do you agree or disagree with this statement? Justify your opinion with relevant examples or your own logic. 3