

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
FINAL YEAR FALL SEMESTER (COMPUTER SYSTEMS ENGINEERING)
EXAMINATIONS 2017-18
BATCH 2014-2015

Time: 3 Hours

Dated: 16-03-2018

Max. Marks: 60

Parallel & Distributed Computing - CS-428**Instructions:**

1. Attempt all questions.
2. Be precise in your answers and Make assumptions where necessary.

Question No 1																																	
a)	Discuss Flynn's taxonomy. Categorize the following systems as per Flynn's taxonomy. i. GPGPU ii. Vector Processors iii. Multi core processor iv. Computer cluster			(2)																													
b)	Compute $y = (c + d) + (b^2 - 4 * a * f) / (2 * e * g)$ on a single processor and on a message passing architecture with 3 processors. Also, compute the speedup and efficiency.			(3)																													
c)	Draw sequence diagram of two parallel software components communicating via asynchronous and buffered message passing.			(2)																													
d)	What are cache memory and cache coherence policies? A four-processor shared-memory system implements the MESI protocol for the cache coherence. For the following sequence of memory references, show the state of the line containing the variable <i>a</i> in each processor's cache after each reference is resolved by filling table 1. Also, show all the steps involved in computing each table entry. Assume cache cold start.			(3)																													
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Sequence of Memory References</th><th style="text-align: left;">State of P0's cache</th><th style="text-align: left;">State of P1's cache</th><th style="text-align: left;">State of P2's cache</th><th style="text-align: left;">State of P3's cache</th></tr> </thead> <tbody> <tr> <td>P0 reads a</td><td></td><td></td><td></td><td></td></tr> <tr> <td>P1 reads a</td><td></td><td></td><td></td><td></td></tr> <tr> <td>P2 reads a</td><td></td><td></td><td></td><td></td></tr> <tr> <td>P3 writes a</td><td></td><td></td><td></td><td></td></tr> <tr> <td>P0 reads a</td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	Sequence of Memory References	State of P0's cache	State of P1's cache	State of P2's cache	State of P3's cache	P0 reads a					P1 reads a					P2 reads a					P3 writes a					P0 reads a						
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Question No 2																																	
a)	Differentiate between the following: i. Direct and Indirect networks ii. Blocking and non-blocking networks iii. Multiple Bus Systems (MBFBMC, and MBCBMC) iv. Omega and butterfly network			(2)																													
b)	Draw a 3-ary 2-fly network and show route of a packet from node 2 to node 6.			(3)																													
c)	Compute the diameter of the following; i. 3D 4x4x4 mesh ii. 128-node Hypercube			(2)																													
d)	Perform detailed comparison between bus, point to point, crossbar, and multistage networks topologies on the basis of metrics like cost, latency and contention.			(3)																													

Question No 3

- a) What is the difference between CPU cores and GPU cores. (1)
- b) Differentiate between following; (3)
- Vector and Array Processor
 - Warp-based SIMD and Traditional SIMD
 - MMX, SSE and AVX SIMD ISA extension
- c) Simulate with the help of graph GPU dynamic warp formation and merging mechanism using the program shown below. Assume total number of threads=20 and total number of threads per warp=5. (3)
- ```

1. If (.....) //branch checking;
{
2. If(.....)//branch checking; Executed by Threads 0, 4, 8, 9, 10, 11
 {
3. Add x, 5;
 Else {
4. Sub x, 5;} // Executed by Threads 0, 8, 9
 }
Else
5. {Add x,6;}
6. Print x

```
- d) Given below is the C code of kernel *SAXPY* = “Single-Precision A\*B+Y” where -A is a scalar (number); -\* is scalar multiplication; -Y is a vector; +- is a vector addition (3)
- ```

void saxpy (int n, float a, float *x, float *y)
{ for (int i= 0; i< N; ++i)
  y[i] = a*x[i] + y[i]; }

```
- Considering the above C code, For a GPGPU device perform following operations;
- Declare and allocate host and device memory
 - Initialize host data $x[i]=1.0f$, $y[i]=2.0f$;
 - Transfer data from the host to the device.
 - Invoke the CUDA kernel *SAXPY* with $N/128$ blocks per grid in y axis. And 128 threads per block in y axis.
 - Write the equivalent CUDA kernel code for *SAXPY* to be executed using multiple blocks.

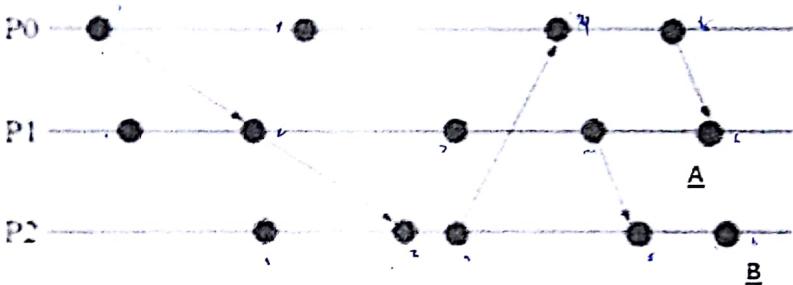
Question No 4

- a) Discuss the 4 subclasses of PRAM model (2)
- b) Write an algorithm for Matrix Multiplication (4)
- CREW
 - CRCW
- Also, compare the performance of both in terms of runtime, no of processors, and cost.
- c) Write the *SORT_CREW* algorithm. Show the execution of algorithm step by step assuming $A=\{50, 2, 6, 9, 3, 0, 3, 6\}$. (3)
- d) “An algorithm designed for a CRCW PRAM can run on an EREW PRAM”; Comment. (1)

Question No 5

- | | | |
|----|--|-----|
| a) | Elaborate the following challenges w.r.t the distributed system <ul style="list-style-type: none">• Communication mechanisms• Naming• Consistency and replication• Group communication, multicast, and ordered message delivery | (4) |
| b) | " REST is a stateless, client-server, cacheable communications protocol which uses HTTP protocol". Comment? | (2) |
| c) | Consider an N-tier distributed client-server architecture configured for evaluating matrix transpose. Produce a six level pseudo code for the system using JAVA RMI. | (4) |

Question No 6

- | | | |
|--|---|-----|
| a) | For the give time-space diagram , determine the following: <ul style="list-style-type: none">• Logical time for each of the process• logical time of the system at the point A and B• Sketch a CUT in the diagram to give a stable global state of the system at any point. | (5) |
|  | | |
| b) | What are the web services? With the help of diagram, discuss the web service stack | (2) |
| c) | How a web service is useful in dealing with the following challenges: <ul style="list-style-type: none">• Interoperability• Firewall traversal• Complexity | (3) |

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Max. Marks: 60

Artificial Intelligence - CS-412

Instructions:

- ✓ Attempt all questions
- ✓ Avoid unnecessary details, keep your answer precise and to the point.
- ✓ Use of diagrams will be appreciated where ever necessary.
- ✓ Maintain the sequence of all parts of question, but sequence at question level is not necessary.

Question #01

10

- a) State whether TRUE or FALSE, not just T or F.
 (First decide, and then state your answer, else this question is to be "negatively marked")
- 1.. The principle of "Proof by Contradiction" proves $(KB \wedge \alpha)$ is unsatisfiable.
 2. Every valid sentence is logically equivalent to TRUE
 3. ~~G~~ is valid iff $\neg\alpha$ is satisfiable
 4. Given $((WumpusAhead \wedge WumpusAlive \rightarrow Shoot) \wedge (WumpusAhead \wedge WumpusAlive))$, using Modus Ponens, "WumpusAhead" can be inferred.
 5. Resolution always produces useful inferences
 6. Every sentence of Propositional Logic is logically equivalent to a disjunction of conjunction of literals
 7. "7 is even" implies "Students at NED are smart" is a true sentence of Propositional Logic.
 8. Hill-Climbing Search is not a complete search algorithm.
 - 9.. Depth-First Search is complete but not optimal.
 - 10.. "Chess Game" is a perfect example of cooperative multi-agent environment.

Question #02

10

- a) KB: $\alpha : R$
1. P
 2. $(P \wedge Q) \rightarrow R$
 3. $(S \vee T) \rightarrow Q$
 4. T
- Show that $KB \models \alpha$

2

- b) Consider the following axioms:
1. Every child loves Santa.
 $\forall x (CHILD(x) \rightarrow LOVES(x, Santa))$
 2. Everyone who loves Santa loves any reindeer.
 $\forall x (LOVES(x, Santa) \rightarrow \forall y (REINDEER(y) \rightarrow LOVES(x, y)))$
 3. Rudolph is a reindeer, and Rudolph has a red nose.
 $REINDEER(Rudolph) \wedge REDNOSE(Rudolph)$
 4. Anything which has a red nose is weird or is a clown.
 $\forall x (REDNOSE(x) \rightarrow WEIRD(x) \vee CLOWN(x))$
 5. No reindeer is a clown.
 $\neg \exists x (REINDEER(x) \wedge CLOWN(x))$

2

6. Scrooge does not love anything which is weird.

$$\forall x (\text{WEIRD}(x) \rightarrow \neg \text{LOVES}(\text{Scrooge}, x))$$

What do you conclude?

c) What are the problems associated with "Simple Reflex Agents"? 2

d) What is a logic? 2

e) Imagine we knew that:

- If today is sunny, then Anas will be happy ($S \rightarrow H$)
- If Anas is happy, the lecture will be good ($H \rightarrow G$)
- Today is sunny (S)

Should we conclude that the lecture will be good?

Use truth table to support your conclusion.

Question#03

10

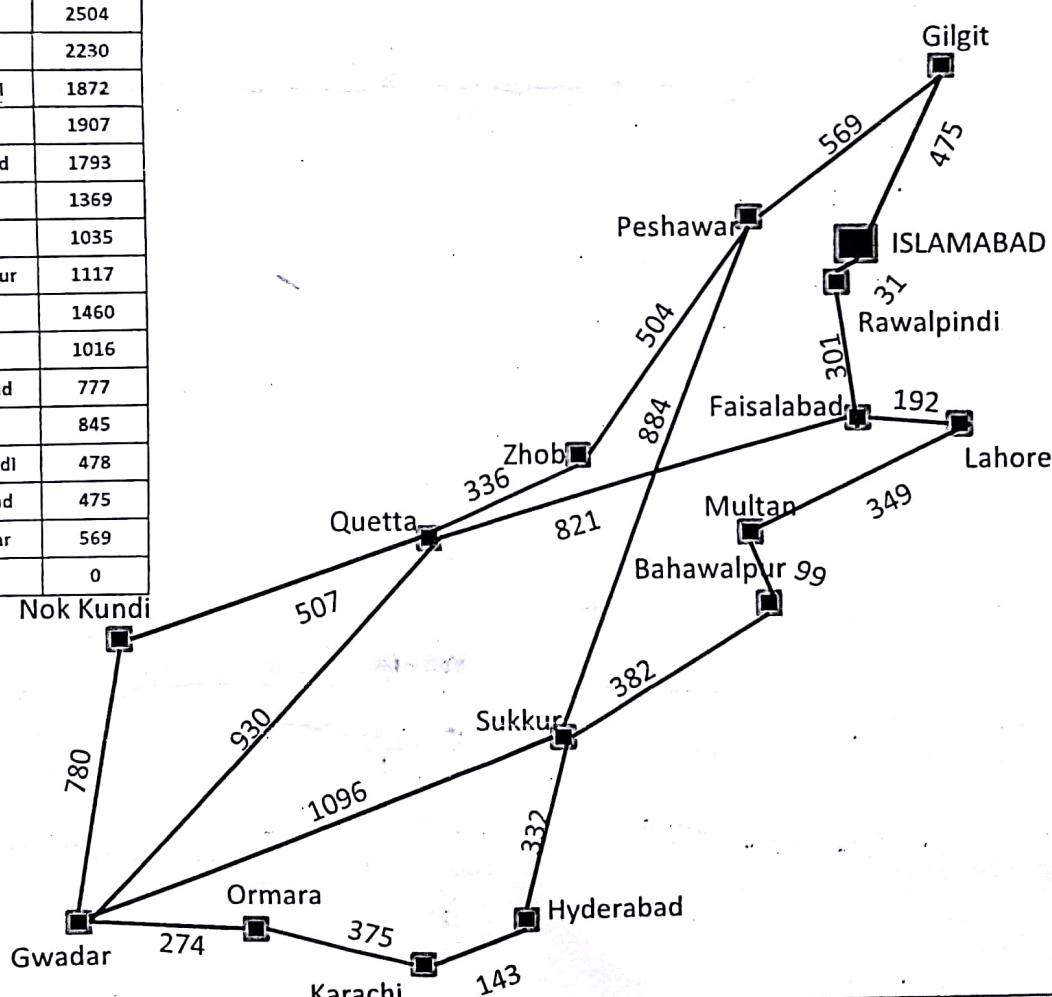
a) Define "logical entailment". 2

b) Resolve $\neg((p \rightarrow q) \wedge (p \wedge q \rightarrow r) \rightarrow (p \rightarrow r))$ in conjunctive normal form 2

c) Define "Agent", and "Rational Agent" 2

d) Given the map of Pakistan and distance from each city to Gilgit, apply A* Search to find a route from MULTAN to GILGIT. Clearly show your search tree and all calculations. 4

Cities distance to Gilgit	
Gwadar	2504
Ormara	2230
Nok Kundi	1872
Karachi	1907
Hyderabad	1793
Quetta	1369
Zhob	1035
Bahawalpur	1117
Sukkur	1460
Multan	1016
Faisalabad	777
Lahore	845
Rawalpindi	478
Islamabad	475
Peshawar	569
Gilgit	0



Question#04

15

- a) Suppose a hospital tested the age and body fat data for 18 randomly selected adults with the following results:

age	23	23	.27	27	39	45	49	50	52
%fat	9.5	26.5	7.8	17.8	31.4	25.9	27.2	31.2	34.6

Calculate the mean, median and standard deviation of age.

3

- b) The given data presents a training set of class-labelled tuples randomly selected from the All Electronics customer database. The `buys_computer` is the class variable in the given dataset. Compute the Gini index for the variable 'Age' and 'Credit_rating'.

6

RID	Age	Income	Student	Credit_rating	Buys_computer
1	youth	high	no	fair	no
2	youth	high	no	excellent	no
3	middle-aged	high	no	fair	yes
4	senior	medium	no	fair	yes
5	senior	low	yes	fair	yes
6	senior	low	yes	excellent	no
7	middle-aged	low	yes	excellent	yes
8	youth	medium	no	fair	no
9	youth	low	yes	fair	yes
10	senior	medium	yes	fair	yes
11	youth	medium	yes	excellent	yes
12	middle-aged	medium	no	excellent	yes
13	middle-aged	high	yes	fair	yes
14	senior	medium	no	excellent	no

- c) Consider $S \in \{\text{slow, medium, high}\}$ ($\text{Speed} \rightarrow \text{Accident}$) and $A \in \{\text{no, average, serious}\}$. The following probabilities of $P(S)$ and $P(A|S)$ are as follows:

$$P(S) : P(S=\text{slow}, .80) : P(S=\text{medium}, 0.15) : P(S=\text{high}, .05)$$

$$P(A|S) :$$

Speed =	slow	medium	high
$P(A=\text{no})$	0.96	0.88	0.60
$P(A=\text{average})$	0.03	0.08	0.25
$P(A=\text{serious})$	0.01	0.04	0.15

Perform the following calculation with the given data set:

1. Product Rule
2. Marginalization
3. Bayes rule

Question#05

15

- a) The following table shows the data of three persons, given their scores on two variables.

	Variable 1	Variable 2
Person 1	20	80
Person 2	30	44
Person 3	90	40

2

Compute the Euclidean distance between (Person 1, Person 3) and (Person 2, Person 3).

b) Consider the 6 objects below and partition them into 3 clusters using k-means algorithm. Choose A, B and E for the initial centres, Euclidean distance for the similarity measure and mean to calculate the new centres. Show clearly all iterations.
A(2,10), B(2,5), C(8,4), D(5,8), E(7,5), F(16,-4)

5

c) Consider the given data. One wants to use this data set as a training set to obtain a decision tree for the variable **Cheat**. Use the Gini index to find the attribute that will be chosen to split the root of the tree. No need to build the all tree, only the first level. Show all your calculations.

4

ID	Refund	Marital Status	Taxable Income	Cheat
1	yes	single	middle	no
2	no	married	middle	no
3	no	single	low	no
4	yes	married	middle	no
5	no	divorced	low	yes
6	no	married	low	no
7	yes	divorced	high	no
8	no	single	low	yes
9	no	married	low	no
10	no	single	low	yes

d) A database has five transactions.

TID	items_bought
T100	{M, O, N, K, E, Y}
T200	{D, O, N, K, E, Y}
T300	{M, A, K, E}
T400	{M, U, C, K, Y}
T500	{C, O, O, K, I, E}

4

Calculate the support and confidence using association rules for {O,K,E}

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Numerical Methods - MT-442

Note: Attempt any five question in all

- Q#1(a) Solve the system of equations by using Gauss-Jordan or Gauss-Elimination method. (06)

$$x + 2y + z = 8$$

$$2x + 3y + 4z = 20$$

$$4x + 3y + 2z = 16$$

- Q#1(b) Solve the system of equations by using any iterative method. Do four iterations. (06)

$$3x + 4y + 15z = 54.8$$

$$x + 12y + 3z = 39.66$$

$$10x + y - 2z = 7.74$$

- Q#2(a) Perform three iterations of the equation $\ln(x - 1) + \cos(x - 1) = 0$ by using Newton Raphson Method to calculate the root by taking initial guess 1.2 (06)

- Q#2(b) Solve the system of equations by using Cholesky method. (06)

$$x + 2y + 3z = 5$$

$$2x + 8y + 22z = 6$$

$$3x + 22y + 82z = -10$$

- Q#3(a) Find the interpolating polynomial by Newton's divided difference formula for the following data (06)

x	0	1	2	4
y	1	1	2	5

- Q#3(b) Use above data to find the interpolating polynomial by Lagrange's formula. Hence show that it represents the same polynomial as in (a). (06)

- Q#4(a) Fit a quadratic spline to the given data. (06)

X	0	10	15	20	22.5	30
Y	0	227.04	362.78	517.35	602.97	901.67

- Q#4(b) An object is suspended in a wind tunnel and the force measured for various levels of wind

Velocity. The results are tabulated below: (06)

V (m/s)	10	20	30	40	50
F (N)	25	70	380	550	610

Fit a power model to the data

- Q#5(a) A missile is launched from a ground station. The acceleration during first 80 seconds of flight, as Recorded, is given in the following table: (06)

t(s)	0	10	20	30	40	50	60	70	80
a(m/s ²)	30.00	31.63	33.34	35.47	37.75	40.33	43.25	46.69	50.67

Compute the velocity of the missile when t=80s, using Simpson's 1/3 rule.

Q#5(b) Use the composite trapezoidal rule with n=8 to estimate the following integral (06)

$$\int_1^5 \sqrt{1+x^2} dx$$

Q#6(a) Find a cubic polynomial in x by using Newton's backward difference. Also estimate f(3.5). (06)

X	0	1	2	3	4	5
F(x)	-3	3	11	27	57	107

Q#6(b) Estimate the first derivative of the function at x=0.5 with h=0.5 (06)

$$f(x) = -0.1x^4 - 0.15x^3 - 0.5x^2 - 0.25x + 1.2$$

By using i) Newton's Forward Difference

ii) Newton's Backward Difference

iii) Newton's Central Difference

Compare your answer with exact derivative by calculating error.

Q#7(a) Using modified Euler's method, obtain the solution of the differential equation (06)

$$f(t, y) = \frac{dy}{dt} = t + \sqrt{y}$$

With the initial condition $y_0=1$ at $t_0=0$ for the range $0 \leq t \leq 0.6$ with step size 0.2

Q#7(b) Solve the following maximization problem by using Simplex method. (06)

$$\text{maximize } P = 70x + 50y + 35z$$

$$\text{subject to } 4x + 3y + z \leq 240$$

$$2x + y + z \leq 100$$

$$-4x + y \leq 0$$

$$x, y, z \geq 0$$

----- X -----

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
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Time: 3 Hours

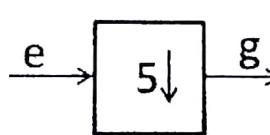
Dated: 14-03-2018

Max. Marks: 60

Digital Signal Processing - CS-419

Instructions:

1. Attempt all questions.
2. Draw diagrams to support your answer where necessary.
3. You can attempt questions in any order but all parts of a question must be in order.

1.	a. What are the basic properties of LSI systems? Give one example of an LSI system. b. Discuss the advantage of IIR systems over FIR systems. c. An IIR lowpass filter has 3 feedforward and 5 feedback coefficients. How many MAC operations the processor needs to perform to compute the discrete signal flowing into the filter at 100KSPS.	5 5 5
	a. Define "Nyquist Sampling". b. Consider the following s-domain expression of analog prototype filter.	5
	$H_a(s) = \frac{1}{1 + 3s + s^2}$ i. For sampling rate of 10 Hz, compute the impulse response $H(z)$ of the corresponding IIR digital filter using bilinear transform method. ii. Write its standard difference equation as a function of n .	5 5
3.	a. Consider the following system. The sampling rate of signal $x_e(n)$ at node 'e' is 40KSPS. Draw the spectrum of the sampled signal $x_g(n)$ with a reduced sample rate of 8KSPS for the range $[-2\pi \leq \omega \leq 2\pi]$. $x_e(n) = 1 + \cos(9 \frac{\pi}{20} n)$ 	10
	b. Compute 4-point DFT of the following sequence $x(n)$: $x(n) = [3, 3, 3, 3]$	5
4.	a. Design a 9-Tap symmetric windowed FIR HPF with $f_c=10$ Hz operating at sampling rate of 40SPS. Use Blackman window given by the following equation. $w(n) = 0.42 + 0.5 \cos\left(\frac{\pi n}{N}\right) + 0.08 \cos\left(\frac{2\pi n}{N}\right) \text{ for } -N \leq n \leq N$ i. Give the complete equation of the designed HPF impulse response. ii. Compute the coefficients of this filter. iii. Plot $w(n)$ and $h(n)$ centered at $n=0$.	5 5 5

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
FINAL YEAR SPRING SEMESTER (COMPUTER SYSTEMS ENGINEERING)
EXAMINATIONS 2018
BATCH 2014-2015

CS-14112

Time: 3 Hours

Dated: 01-09-2018
 Max. Marks: 60

Computer Systems Modeling - CS-417

- Instructions:**
- i. Attempt all questions
 - ii. Answer all parts of a question together
 - iii. Keep the answers relevant and precise
 - iv. If you feel any ambiguity, make necessary assumptions and mention them properly
-

QUESTION #1

[8]

- a) State the basic purpose of software monitoring. Point out any three tasks for which it is most appropriate. [2]
- b) Identify the suitable monitoring technique for each of following measures:- [3]
- i. Number of open files in the system
 - ii. distribution of seek distances for a moving head disk
- Also give appropriate reason for your answer.
- c) A newly developed loan processing application (in C language) was found to be much slower than expected. After some preliminary investigation, it was suspected that the application was spending too much time in verifying the eligibility of loan applicant. Function *verf_elig* is used for verification. Show the instrumentation of *verf_elig* for measuring the fraction of time used for the verification. [3]

QUESTION #2 (CLO-1, C3)

[10]

- a) Consider the Markov chain that has the following (one-step) transition matrix:- [4]
- $$P = \begin{matrix} \begin{array}{c|cccccc} \text{State} & 0 & 1 & 2 & 3 & 4 & 5 \\ \hline 0 & 0 & 0 & 0 & \frac{2}{3} & 0 & \frac{1}{3} \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 \\ 2 & 1 & 0 & 0 & 0 & 0 & 0 \\ 3 & 0 & \frac{1}{4} & 0 & 0 & \frac{3}{4} & 0 \\ 4 & 0 & 0 & 1 & 0 & 0 & 0 \\ 5 & 0 & \frac{1}{2} & 0 & 0 & \frac{1}{2} & 0 \end{array} \end{matrix}$$
- i. Determine the classes of this Markov chain and, for each class, determine whether it is recurrent or transient.
 - ii. For each of the classes, determine the period of the states in that class.
 - iii. Classify the given Markov chain as either ergodic or not? Provide proper reason.
- b) A computer is inspected at the end of every hour. It is found to be either working or failed. If the computer is found to be up, the probability of its remaining up for the next hour is 0.95. If it is down, the computer is repaired, which may require more than 1 hour. Whenever the computer is down (regardless of how long it has been down), the probability of its still being down 1 hour is 0.5.
- i. Construct the (one-step) transition matrix for this Markov chain.
 - ii. Calculate the steady-state probabilities of the state of this Markov chain.
- c) In an M/M/3 system, jobs arrive at the rate of 12 jobs/sec. Calculate the service rate (jobs/sec) beyond which the system would remain stable. [1.5]
- d) Construct kendall's notation (in most simplified form) for a queuing process having deterministic interarrival and exponential service times, three parallel servers, with only 100 out of virtually infinite number of customers allowed in the system and FCFS queue discipline. [1.5]

QUESTION #3 (CLO-2, C4)

[10]

- a) Figure out the following expression for the waiting time (in system) distribution in an M/M/1 queuing system:- [4]

$$W(t) = e^{-(\mu-\lambda)t}, t > 0$$

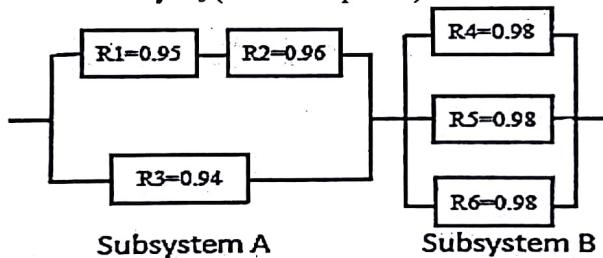
- b) On a network gateway, measurements show that the packets arrive at a mean rate of 180 packets per second (pps) and the gateway takes an average of 2.5 milliseconds to forward them. Both the inter-arrival and service times are following exponential distribution. Figure out the following quantities using appropriate queuing model:- [6]

- i. Probability of more than two packets in the systems
- ii. Average packet transmission delay (in msec)
- iii. Average queuing delay for each packet (in msec)
- iv. Average number of packets in the system
- v. Average number of packets waiting to be transmitted
- vi. 90th percentile waiting time in the system

QUESTION #4 (CLO-3, C4)

[10]

- a) The computing facility of a pharmaceutical company has a single printer. The print jobs arrive at random according to a Poisson process at an average rate of 12 every 5 minute. It has also been estimated that the number of pages in the documents range from 1 to 12, uniformly distributed. The printer takes a fixed time of 3 seconds for printing one page.
- i. Confirm that the system would attain a steady-state.
 - ii. Figure out the average number of requests in the queue.
- b) Explain that system faults do not always result in failures using any two reasons. [2]
- c) Outline the taxonomy of software reliability models. [2]
- d) A digital system has six components with following interconnection. The subsystem B is a 2-out-of-3 configuration. Figure out the reliability R_s (4 decimal places) of the entire digital system. [3]



QUESTION #5 (CLO-1, C3)

[10]

- a) The distribution of the equivalent classes of input and results of test cases for each class are given below:- [2]

Equivalent Class (E_i)	P_i	n_i	f_i
E_1	30%	40	3
E_2	35%	50	4
E_3	35%	50	2

Calculate the reliability (4 decimal places) of the given software based on Equivalent Class Reliability model.

- b) Provide the meaning of trace in trace-driven simulation. Express its main purpose along with two suitable examples. [3]
- c) Compute the following integral using the Monte Carlo simulation (use six iterations):- [3]

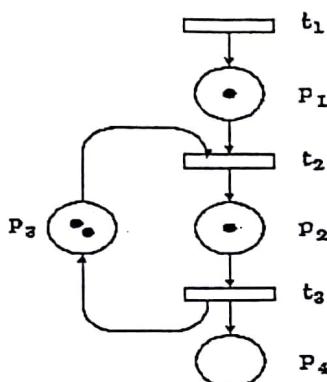
$$I = \int_{-2}^5 x^3 dx$$

- d) Requests for a page at a web server arrive randomly, every 3 milli-secs on the average, following negative-exponential distribution. Apply the Inverse Transformation method, algebraically, to select three random observations for time-period-until-next-arrival of requests (in milli-secs) by using the following uniform random numbers: 0.1765, 0.4097 and 0.9132. [2]

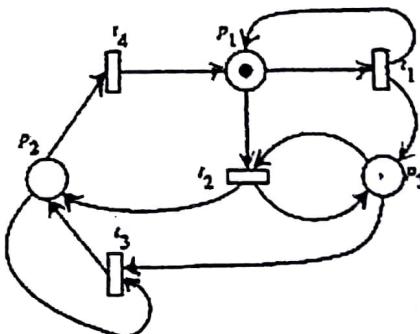
QUESTION #6 (CLO-3, C4)

[12]

- a) Identify suitable notion for following blanks:-
- Petri nets are used for modeling _____ behavior of concurrent systems. [3]
 - A marking defines the number of _____ in each place of the Petri net.
 - A Petri net is _____ if there are no transitions in the net that are enabled.
 - A PN is safe if each _____ is safe.
 - In a timed-PN, a transition fires once the timer reaches _____.
 - In _____ firing semantics, as soon as the transition is enabled, it removes its enabling tokens from the input places.
- b) Diagram a simple PN in which transition fires only when there are less than n items in the input place. [1]
- c) Following PN models a finite buffer. Briefly explain its operation by highlighting the function of each place and transition. [2]



- d) Consider a Petri net with initial marking as shown below:- [3]



Use matrix analysis to select Petri net marking subsequent to the sequence of following transition firings: $t_1 \rightarrow t_2 \rightarrow t_3 \rightarrow t_4 \rightarrow t_1 \rightarrow t_2 \rightarrow t_3$.

- e) Consider a multiprocessor system with no. of processors, $N=2$ and no. of memory modules, $M=2$. Let the vector K represents the system state in terms of requests for each memory module and vector G represents a new feasible system state. Now using the general formula, figure out the state transition matrix P and outline the state transition diagram. [3]

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
FINAL YEAR SPRING SEMESTER (COMPUTER SYSTEMS ENGINEERING)
EXAMINATIONS 2018
BATCH 2014-2015

Time: 3 Hours CS-14112

Dated: 28-08-2018
Max. Marks: 60

Entrepreneurship for Computer Engineers - CS-425

Instructions:

- Question paper related queries will not be entertained after 30 minutes of the start of the examination.
- Your answers should be concise and should reflect your professional approach towards the subject

Q1. In the context of your venture, answer the following questions.

(15 Marks)

- a) Write down your startup title, slogan, and vision statement?
- b) How will you do business in an ethical way?
- c) Draw the Payment Flow diagram, highlight transactions and activities with customers and/or partners.
- d) What will be the break-even point of your startup?
- e) How will you execute the startup? Show your detailed execution plan.

Q2. While working on your startup, list any FIVE hypotheses that went wrong or added at the later stage during the customer discovery of your startup? Highlight either these assumptions are ITERATIONS or PIVOTS, what was your response and what you have achieved? Use below table format to answer the questions. (10 marks)

S. No. ²	DESCRIBE HYPOTHESIS (what you thought?)	ITERATE or PIVOT (which part of business model)	RESPONSE (what you did?)	END RESULT (outcome)
1 to 5				

Q3. During the semester, you have come across with various business ideas presented by startups. Excluding your group, choose any 1 startup and give FIVE recommendations which you feel as an entrepreneur are missing from that business model and by implementing your suggestions that startup will be more effective and closer to reality. Support your answers with logical reasoning. (5 marks)

Q4. During the course, you have asked to interview an entrepreneur. Evaluate his/her journey towards entrepreneurship by answering follow questions. (5 Marks)

- a) What characteristics do he/she has?
- b) What background and motivation do he/she has to be an entrepreneur?
- c) Why do you think he/she has succeeded as an entrepreneur?
- d) What is unique about his/her business?
- e) What key learnings will you apply on yourself as an Entrepreneur?

Q5. In Pakistan, there are many problems which we are facing since decades, especially Education and Security. Being a Pakistani Entrepreneur, answer the following questions. (10 marks)

- a) Define the GENUINE problem that exist in Pakistan (it should be from above problems)
- b) Proposed an INNOVATIVE solution (write briefly)
- c) Sketch the diagram of your proposed prototype
- d) Develop a business model for this idea using Business Model Canvas.

Note: The idea should be new and shall not be the one which you have discussed in the class.

Q6. Read below startup pitch.

(05 marks)

InstyMeds

Business Idea:

Provide patients access to prescription medications instantly after they're prescribed by a doctor in a hospital emergency room or at an urgent care center. The prescriptions are dispensed via a vending machine that's present in the facility.

Pitch:

There are many rural areas without 24-hour pharmacies. This make it difficult for people who visit an emergency room or an urgent care center late at night or on a weekend to quickly fill their prescriptions. Typically, of course, we want to have immediate access to medications that a doctor has told us will make us feel better! In some cases, doctors will give patients a starter quantity of a medication, if they know the patient will not be able to get to a pharmacy soon. But there are two problems with this solution. First, it's costly for the doctors and hospitals. Second, a likely scenario is that the patient will take the starter medications, start feeling better, and never have the prescription filled. This leaves patients who started out with bronchitis, for example, susceptible to pneumonia if they don't take their full regimen of medication and their condition takes a turn for the worse.

InstyMeds provides a solution to these problems. The company has developed a vending machine for prescription drugs, to be located in hospitals and urgent care centers. Here's how it works. If you've just received a prescription from a doctor at an emergency room or an urgent care center that has an InstyMeds machine, your prescription will be accompanied by an InstyMeds private code. You approach the InstyMeds machine (which resembles an ATM) and enter the code. The online prompts then lead you through the process. If you have insurance, InstyMeds will ask for your insurance information and will determine the co-pay for your prescription. If you do not have insurance, InstyMeds' machine allows you to pay with cash or credit card. Following payment, your prescription will then be dispensed. InstyMeds doesn't work for all prescriptions, like those that need to be refrigerated, but does include the 100 or so most common medications prescribed by emergency room and urgent care physicians. If the patient has questions, each InstyMeds machine has a phone that directly connects the patient to InstyMeds' call center where licensed pharmacists are on duty.

The advantages of InstyMeds' operations create a "win-win" situation for both patients and hospitals and urgent care facilities. The facilities where the machines are present share in the income they produce. Hospitals and urgent care centers have also found that patients who are seen in the middle of the day, with a pharmacy nearby, still use the InstyMeds machine to avoid the wait time one normally experiences at a pharmacy. The InstyMeds machines are supported by a full support system. Each machine is connected to the Internet, which alerts InstyMeds' headquarters if certain medications need to be replenished or if there are any medications present that need to be replaced due to nearing expiration dates.

Answer the following questions:

- a) If you had to make your decision on the information provided in the pitch, would you fund this company?
Why or why not?
- b) Prepare the Value Proposition Canvas of InstyMeds.

Q7. Case Study: "Zipcar: A Business Model Innovator That's Changing the Way People Think About Cars" (10 marks)

Introduction

Zipcar is a car sharing service that Cambridge, Massachusetts, residents Robin Chase and Antje Danielson launched in 2000. Scott Griffith, a former Boeing engineer, now leads the firm. Although Zipcar didn't pioneer the idea of car sharing—it first emerged in Europe—it is the largest car sharing company, and is changing the way people think about car ownership in urban areas. From its start in 2000, the company now has over 500,000 members. A total of 40 percent of its members say they've either sold a car or have decided to not purchase a car because of their Zipcar membership.



How It Works: Four Simple Steps to Zipcar Freedom

Business Model

Zipcar is a membership-based system. It charges a one-time application fee of \$25 and an annual membership fee of \$50. Zipcar cars have permanent parking spots in convenient locations in urban areas. Each member is given a membership card (called the Zipcard) that gets them into the cars. Reservations can be made from minutes before a car is needed up to a year in advance. Once a reservation is made, the member simply approaches the car, opens it with the Zipcard, and drives it away. It costs about \$9 an hour or \$65 per day to rent a car. The cost includes the car, gas, and insurance. The car must be returned to its original parking space. The member simply leaves the keys in the car, locks it with the Zipcard, and walks away.

Zipcar is an entirely self-service business. As much as it loves its members, it tries to talk to them as infrequently as possible. None of its locations are manned. Cars are available 24 hours a day, seven days a week. As of December 2010, Zipcar offered a fleet of over 8,000 vehicles in urban areas throughout 28 North American states and Canadian provinces, as well as London. Zipcar's goal is to take the concept of car ownership and turn it into a service. As a result, it doesn't see its competition as car rental companies, like Avis or Hertz; rather, it sees its major competition as car owners.

Piggybacking on Environmental Trends

Zipcar envisions itself as ideally positioned to take advantage of environmental trends. Currently, about 50 percent of the world's population lives in urban areas, a number that's steadily on the increase. According to surveys conducted by Zipcar, the two biggest complaints that people who live in urban areas have are (1) the high cost of living and (2) traffic and congestion. Zipcar sees itself as at least a partial solution for both problems. In regard to the high cost of living, Zipcar has found that only about 10 percent to 15 percent of the people who live in urban areas and own cars need them on a daily basis. It costs anywhere from \$6,000 to \$10,000 a year to own a car in an urban area, considering the cost of the car, insurance, maintenance, gas, and parking. In some areas of New York City, for example, it costs upward of \$500 per month just to park a car. According to independent research firm Frost and Sullivan, Zipcar (along with other car sharing programs) can save urban residents 70 percent of their total transit costs, because they only pay for the hours they use the vehicle, with no responsibility for gas, insurance, maintenance, or parking. In regard to congestion, Zipcar has documented what it calls its "1 to 15 phenomena." For every parking place that a city designates for a Zipcar, about 15 cars are taken off the road. This number results from the 40 percent of Zipcar members who say they either sell their car or decide not to purchase one as a result of their Zipcar membership. This statistic hasn't gone unnoticed by city governments, which are trying to develop comprehensive strategies to address traffic congestion. London, for example, has literally removed traffic meters in some locations and has given the parking spots to Zipcar and other car sharing services because they help relieve congestion.

Zipcar also contributes to environmental sustainability, although that's not the point that the company emphasizes in its advertising and promotions. Its cars are energy efficient. Studies have shown that when people rely on a car sharing service rather than owning a car, they drive about 50 percent fewer miles per year. Based

on 500,000 members, Zipcar members reduce CO₂ emissions by more than 500,000 tons a year as a result of fewer miles driven.

Another trend favoring Zipcar is that an increasing number of young professionals are either moving to or staying in urban areas. There are upscale neighborhoods opening in the inner-city in places like Miami, St. Louis, and Atlanta, where young professionals are deciding to locate and start families rather than moving to the suburbs. This demographic is an ideal target market for Zipcar.

How Zipcar's Business Model Changes Its Members' Behaviors

A particularly interesting aspect of Zipcar's business model is how it changes its members' behaviors. The reason people drive less when they use a car sharing service rather than owning a car is that when they pay for a car an hour at a time, they tend to group their trips more efficiently to save money. In addition, they tend to think of alternatives to driving that they might not have thought of otherwise. Through surveys, Zipcar has found that its members not only drive less but use public transportation more often and walk and bike more as a result of their Zipcar memberships. When people own cars, they tend to want to use them to get the full value from the car. When people rent cars by the hour, they tend to not want to use them to save the hourly rental charge. Zipcar is fine with this. It believes by saving individual members money, they will spread the word about Zipcar's service which will lead to more members.

University, Organization, and Business Partnerships

Zipcar has several programs aimed specifically at universities and businesses. In 2004, it launched a program called Zipcar for Business, to allow businesses to use the firm's service in the same way individuals do. Since 2004, it's signed up 10,000 small, medium, and large companies. The program works nicely for both Zipcar and the businesses. Rates are cut for Monday to Friday driving, when businesses use vehicles the most, which helps businesses control/reduce their costs. Zipcar can then rent the same cars to individuals on the weekends, when individuals tend to use cars the most. Zipcar is also active on many university and college campuses. More than 225 universities and colleges are now partnering with Zipcar and providing parking spaces on their campuses.

In 2009, Zipcar launched a service called FastFleet, to help cities use the cars they own more efficiently. Rather than having different departments maintain their own car pools, cities can now maintain a single fleet of vehicles, strategically located throughout the city, and have city employees reserve them and use them in the same manner that Zipcar member reserve and use cars. Zipcar provides the back-end functionality for the system. Washington DC, which was the first city to use the system, reportedly saved more than \$1 million in the first 12 months.

Continual Expansion of the Business and Business Model

Zipcar is still growing rapidly relying on organic growth as well as mergers and acquisitions to do so. In 2007, it merged with Flexcar, its primary domestic competitor. In 2009, it acquired a minority interest in Avancar, the largest car sharing company in Spain. In April 2010, it acquired Streetcar, a London-based car sharing club.

Zipcar pegs the worldwide market for car sharing at about 8 million users. It's currently at 500,000. While it sees continual growth in North America and Europe, it sees its biggest potential market in Asia, an area where it currently doesn't have operations. It's not clear how Zipcar will penetrate Asian markets. Zipcar feels that it has just scratched the surface of its markets and the possibilities its business model presents.

Answer the following questions:

1. What are the main challenges that you feel Zipcar will face in both the immediate and the long-term future?
2. Do you think Zipcar is growing too rapidly? In what ways can rapid growth threaten the strengths of Zipcar's business model?



NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
FINAL YEAR SPRING SEMESTER (COMPUTER SYSTEMS /ELECTRICAL ENGINEERING)
EXAMINATIONS 2018
BATCH 2014-2015

CS-14112

Time: 3 Hours

Dated: 30-08-2018

Max. Marks: 60

Organizational Behaviour - HS-405

Instruction:

- Attempt ALL questions.
- Your answers must be relevant, focused and logically presented as per the needs of the question

Q1. Read the case study given below and complete the questions that follow. **20 Marks (CLO – 3)**

When people think about entrepreneurship, they often think of Guy Kawasaki, who is a Silicon Valley venture capitalist and the author of nine books as of 2010, including *The Art of the Start* and *The Macintosh Way*. Beyond being a best-selling author, he has been successful in a variety of areas, including earning degrees from Stanford University and UCLA; being an integral part of Apple's first computer; writing columns for *Forbes* and *Entrepreneur Magazine*; and taking on entrepreneurial ventures such as cofounding Alltop, an aggregate news site, and becoming managing director of Garage Technology Ventures. Kawasaki is a believer in the power of individual differences. He believes that successful companies include people from many walks of life, with different backgrounds and with different strengths and different weaknesses. Establishing an effective team requires a certain amount of self-monitoring on the part of the manager. Kawasaki maintains that most individuals have personalities that can easily get in the way of this objective. He explains, "The most important thing is to hire people who complement you and are better than you in specific areas. Good people hire people that are better than themselves." He also believes that mediocre employees hire less-talented employees in order to feel better about themselves. Finally, he believes that the role of a leader is to produce more leaders, not to produce followers, and to be able to achieve this, a leader should compensate for their weaknesses by hiring individuals who compensate for their shortcomings.

In today's competitive business environment, individuals want to think of themselves as indispensable to the success of an organization. Because an individual's perception that he or she is the most important person on a team can get in the way, Kawasaki maintains that many people would rather see a company fail than thrive without them. He advises that we must begin to move past this and to see the value that different perceptions and values can bring to a company, and the goal of any individual should be to make the organization that one works for stronger and more dynamic. Under this type of thinking, leaving a company in better shape than one found it becomes a source of pride. Kawasaki has had many different roles in his professional career and as a result realized that while different perceptions and attitudes might make the implementation of new protocol difficult, this same diversity is what makes an organization more valuable. Some managers fear diversity and the possible complexities that it brings, and they make the mistake of hiring similar individuals without any sort of differences. When it comes to hiring, Kawasaki believes that the initial round of interviews for new hires should be held over the phone. Because first impressions are so important, this ensures that external influences, negative or positive, are not part of the decision-making process.

Many people come out of business school believing that if they have a solid financial understanding, then they will be a successful and appropriate leader and manager. Kawasaki has learned that mathematics and finance are the "easy" part of any job. He observes that the true challenge comes in trying to effectively manage people. With the benefit of hindsight, Kawasaki regrets the choices he made in college, saying, "I should have taken organizational behavior and social psychology" to be better prepared for the individual nuances of people. He also believes that working hard is a key to success and that individuals who learn how to learn are the most effective over time.

P.T.O

If nothing else, Guy Kawasaki provides simple words of wisdom to remember when starting off on a new career path: do not become blindsided by your mistakes, but rather take them as a lesson of what not to do. And most important, pursue joy and challenge your personal assumptions.

Case Study Questions:

- a. What is Kawasaki's hiring strategy? What do you think about it?
- b. How did Kawasaki describe a "perfect" leader? What is your perception about it?
- c. Kawasaki recommends the study of Organizational Behavior. Why?
- d. How do you think is the simple words of wisdom given by Kawasaki relevant to individuals starting a new career path?
- e. According to Kawasaki, diversity is what makes an organization more valuable. Why is that so? Explain.
- f. Describe how perception can positively or negatively affect a work environment as per Kawasaki when he says that individuals want to think of themselves as essential to the success of an organization.

Q2. You are applying for the job of sales associate. You have just found out that you will be given a personality assessment as part of the application process. You feel that this job requires someone who is very high in extraversion, and someone who can handle stress well. You are relatively sociable and can cope with some stress but honestly you are not very high in either trait. The job pays well and it is a great stepping-stone to better jobs. How are you going to respond when completing the personality questions? Are you going to make an effort to represent yourself as how you truly are? If so, there is a chance that you may not get the job. How about answering the questions to fit the salesperson profile? Isn't everyone doing this to some extent anyway? These questions are the part of the ethical dilemma you are going through.

Keeping the above mention scenario in mind, answer the following questions: 10 Marks (CLO – 2)

- a. What are the advantages and disadvantages of completing the questions honestly?
- b. What are the advantages and disadvantages of completing the questions in a way you think the company is looking for?
- c. What would you really do in a situation like this?

Q3. Define any **FIVE** of the following terms:

10 Marks (CLO – 2)

- | | |
|------------------------------|--|
| a. Evidence-based management | f. Ability |
| b. Emotional Dissonance | g. Perception |
| c. Organizational Commitment | h. Organizational Citizenship Behavior |
| d. Surface-Level Diversity | i. Group Cohesion |
| e. Stereotype | j. Job Satisfaction |

Q4. Do any **TWO** of the following questions:

10 Marks (CLO – 1)

- a. What are attitudes? Explain the three components of an attitude with examples.
- b. Being a manager is a unique challenge with responsibilities. What are the four principal functions that managers have to perform in an organization?
- c. Lewin's Change Management Model is a simple and easy-to-understand framework for managing change. Explain the model and provide an example of a scenario where the situation needs a change and you accommodate the change with the implementation of this model.
- d. Write any five challenges and opportunities of OB.

Q5. Write a note on the following:

- a. Big five personality model

- b. Organizational Behavior

10 Marks (CLO – 1)

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
 FINAL YEAR SPRING SEMESTER (COMPUTER SYSTEMS ENGINEERING)
 EXAMINATIONS 2018
 BATCH 2014-2015

CS-1410
 Time: 3 Hours

Dated: 04-09-2018
 Max. Marks: 60

Computer Systems Security - CS-426

Instruction: Attempt ALL questions.

Q.1	<p>(a) An application proxy firewall is able to scan all incoming application data for viruses. It would be more efficient to have each host scan the application data it receives for viruses, since this would effectively distribute the workload among the hosts. Why might it still be preferable to have the application proxy perform this function? [4]</p> <p>(b) Suppose that packets sent between Alice and Bob are encrypted and integrity protected by Alice and Bob with a symmetric key known only to Alice and Bob. (I) Which fields of the IP header can be encrypted and which cannot? (II) Which fields of the IP header can be integrity protected and which cannot? (III) Which of the firewalls—packet filter, stateful packet filter, application proxy will work in this case, assuming all IP header fields that can be integrity protected are integrity protected, and all IP header fields that can be encrypted are encrypted? Justify your answer. [4]</p> <p>(c) Broadly speaking, there are two distinct types of intrusion detection systems, namely, signature-based and anomaly-based. (I) List the advantages of signature-based intrusion detection, as compared to anomaly-based intrusion detection. (II) List the advantages of an anomaly-based IDS, in contrast to a signature-based IDS. (III) Why is effective anomaly-based IDS inherently more challenging than signature-based detection? [4]</p>	
Q.2	<p>(a) Suppose that Bob receives Alice's digital certificate from someone claiming to be Alice. (I) Before Bob verifies the signature on the certificate, what does he know about the identity of the sender of the certificate? (II). How does Bob verify the signature on the certificate and what useful information does Bob gain by verifying the signature? (III) After Bob verifies the signature on the certificate, what does he know about the identity of the sender of the certificate? [4]</p> <p>(b) This problem deals with digital signatures. (I). How and why does a digital signature provide integrity? (II). How and why does a digital signature provide non-repudiation? [4]</p> <p>(c) What is Cipher Block Chaining (CBC) and why its needed ? [4]</p>	

Q.3	<p>(a) A particular vendor uses the following approach to intrusion detection. The company maintains a large number of honeypots (Honeypots are deliberately vulnerable computer systems designed to purposely engage and deceive hackers and identify malicious activities performed over the Internet) distributed across the Internet. To a potential attacker, these honeypots look like vulnerable systems. Consequently, the honeypots attract many attacks and, in particular, new attacks tend to show up on the honeypots soon after sometimes even during their development. Whenever a new attack is detected at one of the honeypots, the vendor immediately develops a signature and distributes the resulting signature to all systems using its product. The actual derivation of the signature is generally a manual process.</p> <ul style="list-style-type: none"> a. What are the advantages, if any, of this approach as compared to a standard signature-based system? b. What are the advantages, if any, of this approach as compared to a standard anomaly-based system? c. This system would be classified as a signature-based IDS, not an anomaly-based IDS. Why? d. The definition of signature-based and anomaly-based IDS are not standardized. The vendor of the system outlined in this problem refers to it as an anomaly-based IDS. Why might they insist on calling it an anomaly-based IDS instead of a signature-based system? 	[4]
(b)	<p>The SSL protocol uses public key cryptography:</p> <ul style="list-style-type: none"> a. Design a variant of SSL that is based on symmetric key cryptography. b. What is the primary disadvantage of using symmetric keys for an SSL-like protocol? 	[4]
(c)	<p>SSL and IPSec are both designed to provide security over the network.</p> <ul style="list-style-type: none"> a. What are the significant similarities between the two protocols? b. What are the significant differences between the two protocols? 	[4]
Q.4	<p>(a) Suppose we use symmetric keys for authentication and each of N users must be able to authenticate any of the other N-1 users. Evidently, such a system requires one symmetric key for each pair of users, or on the order of N^2 keys. On the other hand, if we use public keys, only N key pairs are required, but we must then deal with PKI issues.</p> <p>(I) Kerberos authentication uses symmetric keys, yet only N keys are required for N users. How is this accomplished?</p> <p>(II) In Kerberos, no PKI is required. But, in security, there is no free lunch, so what's the tradeoff?</p> <p>(b) Consider the following protocol for adding money to a debit card.</p> <ul style="list-style-type: none"> (i) User inserts debit card into debit card machine. (ii) Debit card machine determines current value of card (in dollars), which is stored in variable x. (iii) User inserts dollars into debit card machine and the value of the inserted dollars is stored in variable y. (iv) User presses enter button on debit card machine. (v) Debit card machine writes value of $x + y$ dollars to debit card and ejects card. <p>This particular protocol has a race condition.</p>	[4]

	<p>(I). What is the race condition in this protocol?</p> <p>(II) Describe a possible attack that exploits the race condition.</p> <p>(III) How could you change the protocol to eliminate the race condition, or at least make it more difficult to exploit?</p> <p>(c) Virus writers use encryption, polymorphism, and metamorphism to evade signature detection.</p> <ul style="list-style-type: none"> a. What are the significant differences between encrypted worms and polymorphic worms? b. What are the significant differences between polymorphic worms and metamorphic worms? 	[4]
Q5		
(a)	Are https based email servers secure ? Briefly describe a protocol which provides end to end email security ? Why end to end secure email protocols are not commonly used or could not gain popularity in general public	[4]
(b)	What is the difference between cloud security and web security ?	[4]
(c)	Name some vulnerabilities or errors (at least four) which lead to insecure software.	[4]