Shahjalal University of Science and Technology

Institute of Information and Communication Technology

BSc (Engg.) in Software Engineering

2nd Year 2nd Semester Final Examination 2021

Course: SWE 237 (Management Information System)

Credits: 2.0 Full Marks: 50 Time: 2 Hours

[Answer every question]

Group A

Q.1 Answer any 2 questions. [2 x 2.5]

a) Define Informal Information with examples.

b) What are the goals sought by systems?

c) What do you understand by Human-Machine systems?

Q.2 Answer any 2 questions. [2 x 10]

a) i) Define Closed, Relatively Closed, and Open Systems with proper diagram. [6]
ii) Briefly explain at least 2 characteristics of Open Organizational Systems. [4]

b) i) What do Information Systems do? Explain with a proper diagram. [5]
ii) Write down some functions of Mid-Level Management. [5]

c) i) What are some disciplines that are contributing to the field of MIS? [4]
ii) Briefly explain the different components of MIS. [6]

Group B

Q.3 Answer any 2 questions. [2 x 12.5]

a) The Human Resource Management (HRM)department in any organization is considered to be highly critical for the entire organization. Its many functions serve as a supportive background for the organization. In order to function optimally, the organization must have the right tools and resources in place. The Human Resource Management (HRM) module is one of the main modules in the Osmany Medical Hospital Automation System. The HRM module encompasses a large number of activities. Hence, the module is divided in some sub-modules:

i) write down the name of 5 sub-modules. [2.5]
ii) What are the expected benefits of the sub-module Leave management? [5]
iii) describe the Process flow diagram of the attendance management sub-module of HRM. [5]

b) The inventory module is vital for any agency for keeping records of all the purchased goods purchased (or already available items). For managing different types of items possibly kept in different stores/locations, an efficient and effective inventory module is a must to have a component in an Automation System. Different items are purchased through different procurement methods are delivered to the agency through a delivery chaalan. The receiving committee then checks the items quality (to make sure they are okay) and upon their acceptance, the items are finally entered into the inventory. The inventory module allows members of the agency to issue different items for use for different periods of time.

i) Write some expected benefits from the Inventory module. [5]
ii) Describe the process description of the Inventory module with a process flow diagram. [7.5]

c) Maintaining accounts in a standard way is one of the most important tasks in any organization whether it is private or public. All kinds of financial activities have to be recorded through a double-entry accounting system. Naturally, it becomes difficult to find any kind of expense or record from the manual register book whenever necessary. This sub-module is designed to manage all kinds of financial activities, records, and transactions electronically to facilitate extensive searches. It also generates all the standard accounting reports.

i) List potential sub-modules of the Accounting module. [2.5]
ii) write some master/System data of the Payroll sub-module. [5]
iii) Draw a Use-case diagram of the Pension Management sub-module. [5]

Shahjalal University of Science and Technology
Institute of Information and Communication Technology (IICT)
Software Engineering
2nd Year 2nd Semester Final Examination' Dec 2021 (Session: 2019-20)
Course Code: SWE 235 Credits: 2 Course Title: Ethics and Cyber Law
Time: 2 hrs Total Marks: 50

Group A

[Answer all the questions]

1. Answer any FIVE 5x1=5

a) What are the typical ethical issues that engineering encounters?
b) Is stealing ALWAYS wrong? When is it right to steal?
c) Would you risk your life to save another person?
d) What is the virtue approach?
e) Define Kant's approach to ethics.
f) What does integrity mean to you?
g) What is copyright?
h) Define trademark.

2. Answer any FOUR 4x2.5=10

a) How ethics is connected to or different from cyber law?
b) What should you do in the following case? Why?

You are supervising a product with specifications that only U.S.-made parts may be used. Late in the project, you discover a sub-contractor has supplied a part with foreign-made bolts. They are not very noticeable and would function identically to U.S.-made bolts. Your customer urgently needs the finished product.

c) What is dilemma in ethics?
d) Write a note on Unauthorized Access.
e) What do you understand by code of ethics?
f) What are the differences between ethics and morality?

3. Answer any TWO 2x5=10

a) Consider two situations below and write your own opinion from the aspect of ethics and law.
   i. Someone got into a quarrel with a rickshaw driver over rickshaw-fare and eventually slapped.
   ii. A beggar approached someone and was asking money. That someone got angry and spewed filth to abuse the beggar.
b) Discuss different approaches in the ethical framework.
c) Have you had ethical dilemmas in your own life? How did you reason your way through them? What ethics theory best matches your approach?

Group B

4. Answer any FIVE 5x1=5

a) What is Trojan horse?
b) How do you can identify phishing emails??
c) What is software piracy?
d) Who are grey hat hackers?
e) What is cyber security?
f) What is identity theft?
g) Define E-Contract?
h) What is stalking?

5. Answer any FOUR 4x2.5=10

a) What is paraphrasing plagiarism?
b) What are the ethics one should consider during reporting of research?
c) What is peer review? What is the main intention?
d) What is the cyber terrorism? Give an example of this kind of crime.
e) What is the punishment for any propaganda or campaign against the Liberation war, Cognition of liberation war, Father of the Nation, National Anthem, or National Flag?
f) What is cyberbullying? What should we do if we are cyberbullied?

6. Answer any TWO 2x5=10

a) What are copyright and fare use? What are the consequences to violate it?
b) Discuss cyber law and cybercrime based on the incident below-

Your friend got access to your computer and posted status on behalf of you.

c) What are the security issues in public wifi? How can we be safe in public free wifi?

Shahjalal University of Science and Technology
Institute of Information and Communication Technology (IICT)
2^{nd} year 2^{nd} Semester Final Examination - 2021
Session—**2019-20** Course No.—**SWE 229**
Course Title—**Algorithm Design & Analysis**
Time—**3 Hours** Credit: **3.00** Total Marks#**100**

Part A

1. Answer the following Questions (Any **Five**). $5 \times 2 = 10$
   (a) What is the purpose of the 'Sieve Function'? State some names of its variation.
   (b) What do understand by open-address hashing? Give an example.
   (c) What is Euler Totient's Function?
   (d) What is the worst case complexity of traditional *BigMod*?
   (e) What is 'Linear Diophantine Equation'? How can it be solved?
   (f) What is the time complexity of 'Extended Euclidian Algorithm'?
   (g) What is the 'Load Factor' in hashing?

2. Answer the following Questions (Any **Four**). $4 \times 5 = 20$
   (a) Using 'Extended Euclid' we can find (x,y) pair which satisfies Ax+By = GCD(A,B). Is this pair (x,y) unique? Why or Why not?
   (b) State the 'Bezout's Identity'. How can you use this theorem to find more root for $ax + by = gcd(a, b)$?
   (c) Find the Modular Inverse for A=77 with respect to M=2567.[Hint: they are co-prime]
   (d) Identify variations of sieve & compare them.
   (e) Prove that
   $\sigma(n) = \frac{p_1^{e_1+1}-1}{p_1-1} \cdot \frac{p_2^{e_2+1}-1}{p_2-1} \cdots \frac{p_k^{e_k+1}-1}{p_k-1}$
   (f) How to find the smallest x where x satisfies the following condition?
   $x \equiv a_1 (mod\ m_1)$
   $x \equiv a_2 (mod\ m_2)$

3. Answer the following Questions (Any **TWO**). $2 \times 10 = 20$
   (a) [i] Prove that the average time complexity for 'Merge Sort' is $n\log(n)$ where n is the number of elements. (5)
   [ii] Write each step to sort the numbers A=[5,9,4,3,1,9] using 'Quick Sort'. (5)
   (b) [i] Write the pseudo-code for generating the GCD of two given numbers using the extended euclidian algorithm that uses constant memory. (5)
   [ii] Modify the pseudo-code in the above question for generating more (x,y) which satisfies the equation that extended euclidian solves. (5)
   (c) Write down the code for the following problem(with explanation in comments) & what approach will you follow.
   Given two integers A and B, find number of primes inside the range of A and B inclusive. Here, $1 \leq A \leq B \leq 10^{12}$ and $B - A \leq 10^5$.

Part B

4. Answer the following Questions (Any **Five**). $5 \times 2 = 10$
   (a) What do you understand by 'min-cut' stated in the maxflow algorithm?
   (b) What is the complexity of the Ford-Fulkerson algorithm?
   (c) What types of problems can be solved by 0-1 knapsack?
   (d) What types of problems can be solved by KMP algorithm? What it's complexity?
   (e) What is stable sorting? Give some names of algorithms for stable sorting.
   (f) Write the space & time complexity for Classic LCS.
   (g) Heap sort provides stability in sorting - true or false.

5. Answer the following Questions (Any **Four**). $5 \times 4 = 20$

(a) Write the pseudo-code for bucket sort and state the time and memory complexity.

(b) Suppose you have two strings s1 = "AGGTAB", s2 ="GXTXAYB". Find the LCS(Longest common subsequence) using dp and write the dp table for this.

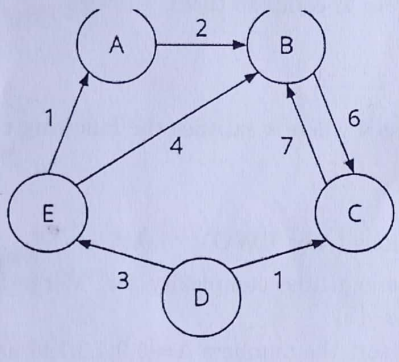
(c) Suppose you caught a thief in your house. He has a bag that can hold upto 8 kg. He has selected items from your house in a particular method that helps him to maximize his profit (suppose the knows the values for each item). You have 4 items labled as A,B,C,D and their corresponding weights are 3,4,5,6 and values 2,3,1,4.
Now what process the thief use to do this job? Describe each steps.

(d) Improve the following code using dp and compare it's time and space complexity with your new code.

```
/* Returns length of LCS for X[0..m-1], Y[0..n-1] */
int lcs( char *X, char *Y, int m, int n )
{
    if (m == 0 || n == 0)
        return 0;
    if (X[m-1] == Y[n-1])
        return 1 + lcs(X, Y, m-1, n-1);
    else
        return max(lcs(X, Y, m, n-1), lcs(X, Y, m-1, n));
}
```

(e) You are given an array $N = [4, 2, 2, 8, 3, 3, 1]$. Sort this array using a stable sort algorithm and illustrate each step. If some steps are same you can explain for the first step then skip the rest.

(f) Illustrate each step for the Floyd-warshall algorithm for the following graph.



6. Answer the following Questions (Any **Two**). $2 \times 10 = 20$

(a) Suppose there are different ways to reach from one chemical A to another chemical B, each method will have sub-reactions involving both heat dissipation and absorption. Now you want to find the set of reactions where minimum energy is required. How will you achieve this? Describe the pseudo-code for your process.

(b) Suppose the array that is to be sorted contains the following elements: 11, 2, 9, 13, 57, 25, 17, 1, 90, 3
Now sort this array using the Heap sort algorithm and state each step. Illustrate the 'heapify' for the first two steps only.

(c) Suppose you have two text txt="ABABDABACDABABCABAB" and pat="ABABCABAB". Construct the LPS that is used in the KMP algorithm to find patterns.

Shahjalal University of Science and Technology
Institute of Information and Communication Technology (IICT)
Software Engineering
2nd Year 2nd Semester Final Examination' Dec 2022 (Session: 2018-19)
Course Code: SWE 227 Credits: 2 Course Title: Theory of Computation
Time: 2 hrs Total Marks: 50

Group A
[Answer all the questions]

1. Answer any FIVE **5x1=5**

a) What is Regular Language?

b) Draw the DFA for the string ends with 'a'.

c) What is ~~PushDown~~ Finite automata?

d) Why do we convert CFG to CNF?

e) What is PushDown Automata?

f) Write the RE for an odd length string.

g) When do you consider a grammar to be ambiguous?

2. Answer any FOUR **4x2.5=10**

a) Construct a DFA over $\Sigma := \{a, b\}$ that accepts the following language: $\{w \in \Sigma * \mid$ each a followed by exactly 1 or 3 b's$\}$

b) Remove unit production from the following grammar.
$S \rightarrow XY$, $X \rightarrow a$, $Y \rightarrow Z|b$, $Z \rightarrow M$, $M \rightarrow N$, $N \rightarrow a$

c) Show that the following languages are not regular: $L = \{a^{n^2} \mid n \geq 1\}$

d) Write the RE that will recognize only the student mail of SUST.

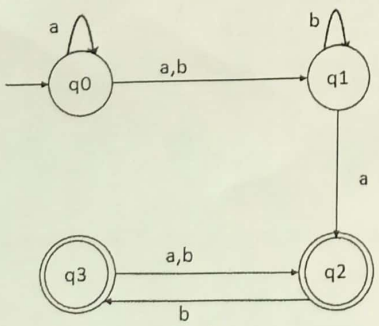
e) What is the Pumping Lemma for Regular language? Using Pumping Lemma, prove that the language $A = \{a^n b^n \mid n >= 0\}$ is not Regular.

f) Prove the following equality by induction for all n >= 0:

$$\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$$

3. Answer any TWO **2x5=10**

a)



Convert the given NFA to DFA.

b) Give state diagrams of DFAs recognizing the following languages. In all parts, the alphabet is {0,1}.
   a. {w| w is any string except 11 and 111}
   b. {w| every odd position of w is a 1}

c) Let S(n) = 1 + 2 + · · · + n be the sum of the first n natural numbers and let $C(n) = 1^3 + 2^3 + \cdots + n^3$ be the sum of the first n cubes. Prove the following equalities by induction on n:
   a. $S(n) = \frac{1}{2}n(n+1)$
   b. $C(n) = \frac{1}{4}n^2(n+1)^2$

Group B

[Answer all the questions]

4. Answer any FIVE 5x1=5

a) What is FSM?

b) What is an escape sequence?

c) What is proof by induction?

d) What is a Turing machine?

e) Give an example of proof by counterexamples.

f) What is a transition function?

g) Write the RE for an even length string only.

5. Answer any FOUR 4x2.5=10

a) Why does the Finite Automata can't solve the counting problem but the PDA can?

b) Give the formal definition of Context Free Grammar.

c) Write regular expressions for the following languages over the alphabet Σ = {a, b}:
(a) All strings that do not end with aa.
(b) All strings that contain an even number of b's.

d) "Every DFA in a NFA but not vice versa" - explain that statement.

e) Show that the following languages are not regular: L = $\{a^p \mid p \text{ prime number}\}$

f) Remove null production from the following grammar. S→ACA, A→aA|B|ϵ, B→bB|ϵ, C→c

6. Answer any TWO 2x5=10

a) Draw the state diagram of TM that recognize the following Language, L = $\{a^n b^n \mid n >= 1\}$

b) Draw the PushDown Automata for the language L = $\{0^n 1^n \mid n>=1\}$ 1+4

c) Write the formal definition of NFA.
Give state diagrams of NFAs with the specified number of states recognizing each of the following languages. In all parts, the alphabet is {0,1}.
   a. The language {w| w ends with 00} with three states
   b. The language $0^*1^*0^+$ with three states

Shahjalal University of Science and Technology

Institute of Information and Communication Technology

BSc (Engg.) in Software Engineering

2nd Year 2nd Semester Final Examination 2021

Course: Numerical Analysis (SWE 231)

Credits: 2.0 Full Marks: 50 Time: 2 Hours

[Answer every question]

Group A

Q.1 Answer any 2 questions. [2 x 2.5]

a) Do you understand the concepts of significant accuracy and precision? Why it is so important in numerical solutions?

b) Determine the approximate root using 3 iterations of the Bisection method and employ the initial guess of $X_L = 5,\ X_U = 10.$ $-0.5x^2 + 2.5x + 4.5$

c) The root of $x^3 = 4$ is found by using the Newton-Raphson method. The successive iterative values of the root are given in the table below.

Iteration number	0	1	2	3	4
Value of the root	2.0000	1.6667	1.5911	1.5874	1.5874

Calculate the iteration number at which you would first trust at least two significant digits.

Q.2 Answer any 2 questions. [2 x 10]

a) Answer the following. [4+6]

i) Discuss the False Position method to find an approximate root of an equation $f(x) = 0$.

ii) Find the real root of the equation $x^3 - x - 1 = 0$ by using the False Position method.

b) Answer the following. [4+6]

i) Derive Lagrange's interpolation formula for unequal intervals.

ii) Using Lagrange's interpolation formula, find the formula of the function $f(x)$ from the following table.

x	0	1	3	4
$f(x)$	-12	0	12	24

c) Answer the following. [5+5]

i) Solve, by Euler's method of the equation $\frac{dy}{dx} = x + y,\ y(0) = 1, for\ 0 \le x \le 1\ taking\ h = 0.1.$

ii) Solve, by Runge-Kutta method of the equation $\frac{dy}{dx} = (x^2 + y^2)/10,\ y(0) = 1, for\ 0 \le x \le 0.4\ taking\ h = 0.1.$

Group B

Q.3 Answer any 2 questions. [2 x 2.5]

a). Recognize the difference between analytical differentiation and numerical differentiation.

b) Calculate the sum of the square of the difference between the data point and its average for the data given by 2, 5, 10, 12, 2.5, and 6.7.

c) Do you think Simpson's rule is better than Trapezoidal rule? Give at least two points in support of your answer.

Q.4 Answer any 2 questions. [2 x 10]

a) Answer the following. [6+4]

i) Using Newton's formula for interpolation, determine y at $x = 3.5$ to the best possible accuracy.

x	0	1.8	5	6	8.2	9.2	12
y	26	16.415	5.375	3.5	2.015	2.54	8

ii) Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ by using the A) Trapezoidal rule, B) Simpson's 1/3 rule.

b) Answer the following. [4+6]

i) Compare the performance of Gauss-Jacobi and Gauss-Seidel iterative method for solution of system of linear equation.

ii) Solve the following system of linear equations by the Gauss-Jacobi iterative method.

$10x - 2y + z = 2$

$-3x + 11y + 2z = 5$

$x - y + 5z = 1$

c) Answer the following. [5+5]

i) Using Newton's forward difference formula derive expressions for the first and second derivatives of a function.

ii) Find the first, second and third derivatives at the point $x = 1.5$ of the function $y = \sqrt{x}$ tabulated below.

x	1.00	1.05	1.10	1.15	1.20	1.25	1.30
$y = \sqrt{x}$	1.00000	1.02470	1.04881	1.07238	1.09544	1.11803	1.14017

Shahjalal University of Science and Technology
Institute of Information and Communication Technology
Software Engineering
2nd Year 2nd Semester Final Exam June 2021 (Session 2019-2020)
Course Title: Operating System and System Programming
Course Code: SWE-233 Credits: 3

Exam Time: 3 Hours Total Marks: 60

Answer all the Questions

Group A

1 Answer any FIVE questions *5 x 1 =5*

a) What is the primary difference between multiprocessing and multiprogramming?

b) State the characteristics of a good process scheduler?

c) What is the convoy effect?

d) State the (two) differences between paging and segmentation?

e) What is a translation look-aside buffer?

f) Write the main advantage of a system with page-based virtual memory compared to a simply system with base-limit registers that implements swapping.

g) What is the Kernel in an OS?

h) What is a Deadlock?

2 Answer any FOUR questions *4 x 2.5 = 10*

a) Name a suitable application for preemptive scheduling and justify your answer.

b) How Buffering can improve the performance of a Computer system?

c) Mention two virtual memory page fetch policies. Which is less common in practice? Why?

d) What are the 5 basic states of a process? Explain with a diagram.

e) "You may request only if you have empty hands" - if we follow this rule to request for any resources by any process, then is there any possibility to happen a deadlock? Justify your answer.

f) Enumerate some pros and cons for increasing the page size.

3 Answer any THREE questions *3 x 5 = 15*

a) Given the following set of processes, draw the Gantt chart for Priority scheduling. Be sure and state any assumptions you make in your solution. Calculate the average wait time for your solution.

Process	Burst Time	Arrival Time	Priority
P1	5	2	1
P2	1	3	2
P3	8	3	3
P4	5	1	2
P5	6	4	4

b) What types of mechanisms you may take to cure deadlocks? Explain in brief.

c) If you are running three programs - FDM (downloading three files), Mozilla (three tabs for email access) and VisualStudioCode (debugging three source-codes), then what will be content of the PCBs for these three programs.

d) List the three memory allocation algorithms and briefly describe their pros and cons. Which one's more commonly used in practice?

Group B

4 Answer any FIVE questions *5 x 1 = 5*

a) Give examples of I/O-bound and CPU-bound processes.

b) What is the Difference between a Job and a Process?

c) Name two CPU scheduling algorithms that can be used both as non-preemptive or preemptive mode.

d) Can you use the FCFS and/or RR as preemptive mode? Justify your answer.

e) When does a page fault occur?

f) Name four disk-arm scheduling algorithms

g) What are the advantages of multiprogramming?

h) State the use of fork() and vfork() system calls.

5 Answer any FOUR questions *4 x 2.5 = 10*

a) What inconveniences that a user can face while interacting with a computer system, which is without an operating system?

b) Suppose that a system is in an unsafe state. Show that it is possible for the threads to complete their execution without entering a deadlocked state.

c) Round-Robin having a optimized time-quanta is one of the best CPU scheduling algorithm. What will be the impact if you choose the value of time-quanta to much lower or to much higher.

d) Memory management is important in operating systems. Briefly, discuss the main problems that can occur if memory is managed poorly.

e) Why is it generally correct to favour I/O bound processes over CPU-bound processes?

f) What is address binding? How many ways of binding instructions and data to memory happen?

6 Answer any THREE questions *3 x 5 = 15*

a) For the given set of processes, with the length of the CPU burst time given in milliseconds, draw the Gantt charts that illustrate the execution of these processes using the scheduling algorithms: FCFS, and RR (quantum = 10). Also show the scheduling order of the processes, calculate the turnaround time & the waiting time for each process, and find the CPU utilization rate. Processes : {P1, P2, P3, P4, P5, P6}, Priorities : {40, 30, 30, 35, 5, 10}, Burst : {20, 25, 25, 15, 10, 10}, Arrival : {0, 25, 30, 60, 100, 105}

b) Wait and Signal are not executed atomically, then mutual exclusion may be violated. Assume that Wait and Signal are implemented as below:

```
void Wait (Semaphore S) {
    while (S.count <= 0) {}
    S.count = S.count - 1;
}
void Signal (Semaphore S) {
    S.count = S.count + 1;
}
```

Describe a scenario of context switches where two threads, T1 and T2, can both enter a critical section guarded by a single mutex semaphore as a result of a lack of atomicity.

c) Consider the following snapshot of a system (P=Process, R=Resource):

	Maximum				Allocated				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P1	3	2	1	4	1	0	1	1	8	5	9	7
P2	0	2	5	2	0	1	2	1				
P3	5	1	0	5	4	0	0	3				
P4	1	5	3	0	1	2	1	0				
P5	3	0	3	3	1	0	3	0				

Answer the following questions using banker's algorithm:

i) Calculate the Needs matrix.

ii) Is the system in a safe state? If so, show a safe execution sequence in which the processes can run.

d) Draw the state diagram of a process from its creation to termination, including all transitions, and briefly elaborate every state and every transition.