

Heaven's Light Is Our Guide
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
4th Year Odd Examination 2020

COURSE NO: CSE 4101 COURSE TITLE: Compiler Design
 FULL MARKS: 72 TIME: 3 Hours

- N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
 (ii) Figures in the right margin indicate full marks.
 (iii) Use separate answer script for each section.

35/51

SECTION : A		Marks
21/31		
Q.1	<p>(a) Explain the roles of linker and loader in compilation process. How are they connected with assembler?</p> <p>(b) Suppose, you have a completely new processor for which no compilers exist yet. Nevertheless, you want to have a compiler that not only target this processor, but also runs on it. In other words, you want to write a compiler for a language A, targeting language B (the machine language) and written language B. How can you do it?</p> <p>(c) Write the outputs of different phases of a compiler for $a = a + b * c * 2$; type of a, b, c are float.</p>	<p>3 2/2</p> <p>4 1/1</p> <p>5 3/5</p>
Q.2	<p>(a) Suppose, lexical analyzer faces the following C statement: $f_i(a=f(x)) \dots$, where it can not tell whether f_i is a misspelling of the keyword if or an undeclared function identifier. How can a lexical analyzer recover from this situation?</p> <p>(b) Write short notes on: Kleene closure, Positive closure, Character classes.</p> <p>(c) Consider the following statement: $do\ i = i+1; while\ (a[i] < v)$; Now generate the abstract syntax tree and three address code of the above statement.</p> <p>(d) Divide the following C++ program: <pre>float limitedsquare (x) { float x; return (x <= -10.0 x >= 10.0) ? 100 : x*x; }</pre> into appropriate lexemes. Which lexemes should set associated lexical values? What should those values be? </p>	<p>2 2/2</p> <p>3 2/2</p> <p>3 1/3</p> <p>4 1/4</p>
Q.3	<p>(a) What do you mean by regular expression and regular definition? Explain with examples.</p> <p>(b) What is input buffering? How can you speed up the lexical analyzer? Give example.</p> <p>(c) Convert NFA of $xx^* yy^*$ to DFA with figure.</p>	<p>3</p> <p>4</p> <p>5</p>
Q.4	<p>(a) Differentiate between Top down parsing and Bottom up parsing with figure.</p> <p>(b) Perform Top down parsing and Bottom up parsing on the following grammar: $Statement \rightarrow if\ Expr\ then\ Statement\ else\ Statement$ $Expr \rightarrow a$ for expression: if a then a. Show parse tree for the expression. </p> <p>(c) Consider the following grammar: $A \rightarrow Ba$ $B \rightarrow dab Eb$ $E \rightarrow cB Ac$ Does this grammar satisfy LL(1) condition. </p>	<p>3 2/3</p> <p>5 3/5</p> <p>4 1/4</p>

SECTION : B

14/26

Q.5	(a) Differentiate between Syntax Directed Definition (SDD) and Syntax Directed Translation (SDT).	3										
✓(b)	Consider the following SDD:	5 5/5										
6/9	<table> <tr> <th>Production</th><th>Rules</th></tr> <tr> <td>$X_0 \rightarrow X_1 + Y$</td><td>$X_0.a \leftarrow Y.a + X_1.a$</td></tr> <tr> <td>$X_0 \rightarrow Y$</td><td>$X_0.a \leftarrow Y.a$</td></tr> <tr> <td>$Y \rightarrow 1$</td><td>$Y.a \leftarrow 2$</td></tr> <tr> <td>$Y \rightarrow 0$</td><td>$Y.a \leftarrow -1$</td></tr> </table>	Production	Rules	$X_0 \rightarrow X_1 + Y$	$X_0.a \leftarrow Y.a + X_1.a$	$X_0 \rightarrow Y$	$X_0.a \leftarrow Y.a$	$Y \rightarrow 1$	$Y.a \leftarrow 2$	$Y \rightarrow 0$	$Y.a \leftarrow -1$	
Production	Rules											
$X_0 \rightarrow X_1 + Y$	$X_0.a \leftarrow Y.a + X_1.a$											
$X_0 \rightarrow Y$	$X_0.a \leftarrow Y.a$											
$Y \rightarrow 1$	$Y.a \leftarrow 2$											
$Y \rightarrow 0$	$Y.a \leftarrow -1$											
	Determine value of "a" attribute of X for input "1+0" and "0+0" using attributed parse tree.											
(c)	Write SDT to build Abstract Syntax Tree (AST) for the following program snippet: if (a>2) c = a++;	4 1/4										
Q.6	(a) Briefly mention the possible actions that a shift-reduce parser can make.	2 1/1										
4/10	(b) What are the operations of the following functions in LEX and YACC: i) yylex(), ii) yywrap(), iii) yyparse()	3 2/2										
	(c) The following is a grammar for regular expressions over symbols a and b only, using	3 0/3										

+ in place of | for union, to avoid conflict with the use of vertical bar as a metasymbol in grammars:

$\text{rexpr} \rightarrow \text{rexpr} + \text{rterm} | \text{rterm}$

$\text{rterm} \rightarrow \text{rterm} \text{rfactor} | \text{rfactor}$

$\text{rfactor} \rightarrow \text{rfactor}^* | \text{rprimary}$

$\text{rprimary} \rightarrow a | b$

i) Left factor the above grammar.

ii) Does left factoring make the grammar suitable for top-down parsing?

iii) Eliminate left recursion from the above grammar.

4/4
4/7 Calculate the FIRST and FOLLOW functions for the following grammar:

$S \rightarrow aBDh$

$B \rightarrow cC$

$C \rightarrow bC | c$

$D \rightarrow EF$

$E \rightarrow g | c$

$F \rightarrow f | c$

Q.7 (a) Briefly explain the contents of a general activation record. 3

(b) In a language that passes parameters by reference, there is a function $f(x,y)$ that does the following: 3

$x = x + 1; y = y + 2; \text{return } x + y;$

If a is assigned the value 3, and then $f(a,a)$ is called. What will be returned?

(c) Consider the following C code to compute Fibonacci numbers recursively. 6

```
int f(int n) { int t, s;
```

```
if (n < 2) return 1;
```

```
s = f(n-1);
```

```
t = f(n-2);
```

```
return s+t;
```

```
}
```

Suppose that the activation record for f includes the following elements in order: (return value, argument n , local s , local t), there will normally be other elements in the activation record as well. The questions below assume that the initial call is $f(5)$.

i) Show the complete activation tree.

ii) What does the stack and its activation records look like the first time $f(1)$ is about to return?

iii) What does the stack and its activation records look like the fifth time $f(1)$ is about to return?

Q.8 (a) What is peephole optimization? Mention its characteristics. 2

4/7 (b) A lexical analyzer uses the following patterns to recognize three tokens T_1 , T_2 and T_3 over the alphabet $\{a,b,c\}$. 3 3/3

$T_1: a?(b|c)^*a$

$T_2: b?(a|c)^*b$

$T_3: c?(b|a)^*c$

Note that the analyzer outputs the token that matches the longest possible prefix. Now, what will be the sequence of tokens produced by the analyzer if the string $bbaacabc$ is processed?

4/4 (c) Generate machine instructions for the following three-address statements assuming a and b are arrays whose elements are 4-byte values. 4 1/4

i) $x = a[i]$

$y = b[j]$

$a[i] = y$

$b[j] = x$

ii) $x = a[i]$

$y = b[x]$

$a[i] = y$

(d) For the grammar $S \rightarrow 0S1 | 01$, indicate the handle in each of the following right-sentential forms during bottom-up parsing. 3

i) 000111, ii) 00S11

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COURSE NO: CSE 4103
 FULL MARKS: 72

COURSE TITLE: Digital Signal Processing
 TIME: 3 Hours

- N.B. (i) Answer any SIX questions taking any THREE from each section.
 (ii) Figures in the right margin indicate full marks.
 (iii) Use separate answer script for each section.

44/48

SECTION : A

34/36

Marks

- Q.1. (a) Explain, "Digital Signal Processing". Write down the advantages of digital signal processing over analog signal processing. 4 4/4

- (b) Determine whether each of the following signals is periodic or not. In case a signal is periodic, specify its fundamental period. 4 4/4

- 12/12
- $x(n) = 3\cos(5n + \pi/6)$
 - $x(n) = \cos(n/8) \cos(n\pi/8)$
 - $x(n) = \cos 0.02\pi n$
 - $x(n) = \cos 3\pi n$

- Q.2. (a) Briefly explain sampling and quantization with proper example. 4 4/4

- (b) Consider the following signal:

$$x(n) = \{ \dots, 0, 0, 1, 2, -1, 3, 4, -1, 2, 3, 1, 0, \dots \}$$

Now for the given signal

- 12/12
- Determine and sketch the even part of $x(n)$
 - Determine and sketch the odd part of $x(n)$
 - Determine and sketch the response of the system described by $y(n) = -x(-n+3)$.
 - Determine and sketch the response of the system described by $y(n) = x(n/2-2)$.

- Q.3. (a) Write down the steps involved in computing convolution. If the impulse response of a linear time-invariant system is 5 5/5

$$h(n) = \{0, 2, 1, 3, -1, 2, 0\}$$

then determine the response of the system to the input signal

$$x(n) = \{ \dots, 0, 4, 5, 1, 2, 0, \dots \}$$

- Q.3. (a) Write down the requirements that needs to be satisfied for a system to be linear. 3 1/3

- (b) When a system is called BIBO stable? Determine the range of values a and b for which the linear time-invariant system with impulse response $h(n) = \begin{cases} a^n, & n \geq 0 \\ b^n, & n < 0 \end{cases}$ is stable. 5 5/5

- 16/12 (c) Determine the convolution of the following sequences in Fourier domain and sketch the output signal: 4 4/4

$$x_1(n) = x_2(n) = \{1, 0, 1\}$$

- Q.4. (a) Prove that an energy signal has zero power while a power signal has infinite energy. 4
 (b) Write the basic principle for pole zero placement in digital filter design. 2
 (c) Determine the z-transform of the following signals and sketch the corresponding pole-zero patterns. 6

- $x(n) = na^n u(n)$
- $x(n) = a^n (\sin \omega_0 n) u(n)$
- $x(n) = \begin{cases} a^n, & 0 \leq n \leq 7 \\ 0, & \text{otherwise} \end{cases}$

SECTION : B

10/12

- Q.5. (a) Determine the causal signal $x(n]$ whose Z-transform is given by 4 4/4
 $X(Z) = (1+Z^{-1})/(1-Z^{-1}+0.5Z^{-2})$

- 7/7 (b) Compute the response of the system $y(n) = 0.7y(n-1) - 0.12y(n-2) + x(n-1) + x(n-2)$ to the input $x(n) = nu(n)$. Is the system stable? 5

- (c) Determine the impulse response of the system $H(Z) = (Z^{-1} + \frac{1}{2}Z^{-2})/(1 - \frac{3}{5}Z^{-1} + \frac{2}{25}Z^{-2})$. 3 3/3

- Q.6. (a) Derive the Fourier transform pair equations for analysing the frequency of continuous signal and hence give the Fourier transform pair for discrete time signal. 3

- (b) Explain what type of problem will be arise when Fourier transform is applied for a discrete signal which has finite numbers of discontinuity. 2
- (c) Consider the signal given below: 4

$$x(t) = \begin{cases} 1 - \frac{|t|}{\tau}, & |t| \leq \tau \\ 0, & \text{elsewhere} \end{cases}$$

Determine and sketch its magnitude and phase spectra respectively.

- (d) Calculate power and energy density spectrum of the signal $x(n) = a^n u(n-1)$, where $-1 < a < 1$. 3
- Q.7. (a) Prove that $x(n) = x_1(n) * x_2(n) \xleftrightarrow{F} X_1(\omega)X_2(\omega)$ where $x(n)$ is the convolution of the signals $x_1(n)$ and $x_2(n)$. Also assume that, $x_1(n) \xleftrightarrow{F} X_1(\omega)$ and $x_2(n) \xleftrightarrow{F} X_2(\omega)$. 3
- (b) State Wiener-Khinchine theorem. Determine the energy density spectrum of the signal $x(n) = a^n u(n)$, where $-1 < a < 1$. 4
- (c) Construct a relation between Z-transform and Fourier transform. 2
- (d) Determine the Fourier transform of the following signal $x(n)=u(n)$ by evaluating their Z-transform on the unit circle. 3

- Q.8 (a) A linear time invariant system is characterized by its impulse response $h(n) = \left(\frac{1}{3}\right)^n u(n)$. Determine the spectrum and the energy density spectrum of the output signal when the system is excited by the signal $x(n) = \left(\frac{1}{4}\right)^n u(n)$. 3 0/1

- 3/5 (b) A two pole lowpass filter has the system function $H(Z) = \frac{b_0}{(1-pZ^{-1})^2}$. Now determine the values of b_0 and p such that the frequency response $H(\omega)$ satisfies the conditions $H(0) = 1$ and $\left|H\left(\frac{\pi}{4}\right)\right|^2 = \frac{1}{2}$. 4

- (c) Compute the DFT of the four point sequence $x(n) = (0,1,2,3)$. 3 3/3

- (d) Write a short note on the followings: 2 0/1

- Notch Filter.
- Comb Filter.
- Bandpass Filter.
- Digital Resonators.

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4th Year Odd Semester Examination 2020
COURSE NO: CSE 4105 COURSE TITLE: Digital Image Processing
FULL MARKS: 72 TIME: 3 HRS

- N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION : A

Marks

- Q.1. (a) What is meant by digital image processing? Write some important applications of digital image processing. 4 2/4
(b) Explain the necessity of image histogram. Draw and describe the histogram of the following images: 4 3/4
Bright image, Dark image, Low contrast image, and High contrast image.
(c) Explain path connectivity in the pixels of an image. Find out the shortest 4-path, 8-path, and m-path between pixels p and q shown in the following image: 4 4/4

4 2 3 2(q)
3 3 1 3
2 3 2 2
(p) 2 1 2 3

$V = \{1, 2\}$

- Q.2. (a) What is contrast stretching? What effect does it have on image histogram? 3 1/3
(b) What is aliasing? Why an aliasing phenomenon can be occurred in case of DIP? 3 1/3
(c) Consider the image subsets S_1 and S_2 given below 6 6/6

	S_1	S_2	
2	2 2 2 2	2 2 4 4	2
4	2 2 4 2	2 4 2 2	4
4	2 2 4 2	4 4 2 2	2
2	2 4 4 4	2 2 2 2	2
2	2 4 4 4	2 2 4 4	4

For $V = \{4\}$, determine whether S_1 and S_2 are i) 4-connected, ii) 8-connected, and iii) m-connected.

- Q.3. (a) Write down the general form of $H(u,v)$ in the frequency domain for, i) Ideal low pass filter, ii) Butterworth low pass filter, and iii) Gaussian low pass filter. 4
(b) How can you detect the edges of following intensity profiles? 4 1/4



- (c) Consider the image strip:

1	1	4	3	2	1	0	0	0	2	0	0	0	0	1	1	1	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Summarize the edge responses considering first order and second order derivative on the strip. 4 4/4

- Q.4. (a) How can you remove double line effect resulted from laplacian mask? 3
(b) Why high boost filtering is necessary for image processing? What are the advantages of high boost filter over high pass filter? 4
(c) What is ringing effect? How can you remove it? 3
(d) How median filter can remove salt and pepper noise? 2

SECTION : B

- Q.5. (a) Define Entropy of an image. Using the following probabilities, find out the Huffman code, source entropy and efficiency. 4 4/4
0.3, 0.1, 0.4, 0.06, 0.04, 0.1
(b) Find the entropy of the following segment- 4 4/4

3	4	5	6
7	5	7	8
7	6	5	4
9	8	5	3

- (c) What is derivative filter? Derive mathematical formulations for Roberts mask and then find Prewitt and Sobel masks. 4 1/1

- Q.6. (a) Describe the process of image segmentation by global and adaptive thresholding. 4
 (b) Briefly explain the stages of k-means clustering process for segmentation. 3 3/3
 (c) Below are the two objects and a structuring element. Explain opening and closing on both of the objects with the structuring element. 5 2/5



- Q.7. (a) Explain the use of DWT instead of DCT in JPEG. 3
 (b) Consider the following sub image: 6 6/6

A	A	B	B	B	C
A	A	A	B	B	C
B	B	A	C	C	C
A	A	A	B	C	C
A	A	B	B	C	C
A	A	A	A	B	B

Find out the compression ratio and redundancy level for the encoding approaches if applied on the sub image:-

- i) Huffman coding, ii) Run Length Coding, iii) DPCM. 3
 (c) Write short note: i) PSNR, ii) SNR 4
 Q.8. (a) Define DFT and wavelet transformation. Distinguish between Fourier transform and wavelet transform. 4
 (b) Briefly describe continuous wavelet transform. 4
 (c) Distinguish between lossless and lossy compression using some examples. 4

RAJSHAH UNIVERSITY OF ENGINEERING & TECHNOLOGY
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4th Year Odd Semester Examination 2020

COURSE NO: CSE 4107

COURSE TITLE: Information System Analysis and Design

FULL MARKS: 72

TIME: 3 Hours

- N.B. (i) Answer any SIX questions taking any THREE from each section.
 (ii) Figures in the right margin indicate full marks.
 (iii) Use separate answer script for each section.

39/57

SECTION : A

19/27

Marks

- Q.1. (a) What is a system? Describe briefly the characteristics of a system. 4
 (b) Write the differences between boundary and interface. 2
 (c) What activities make up system design? How does system design simplify implementation? 4
 (d) It is said that business organizations are dynamic system. How they differ from static system? 2

- Q.2 (a) Explain briefly the levels of structuring work units in system development life cycle with prototyping. 4

- (b) Elaborate on the technical and interpersonal skills required of systems analysis. When is one skill favored over the other? 4 2/3

- (c) Distinguish between the following: 4 2/2

i) Brainstorming and the Delphi method.

ii) On-site observations and interviews and questionnaires.

- Q.3 (a) How can you prepare a feasibility report? Explain. 4 2/4

- (b) Describe the cost/benefit categories of system analysis. 4 2/4

- (c) What are the importances of payback analysis method of cost/benefit analysis? Write down with a suitable example. 4 3/4

- Q.4 (a) If you were to interview the technical team members to obtain the information of technical business projects and solutions (map, analyse, and document business processes and projects) and you have five working days to acquire the information. Which of the following methods would you use and why? 4 4/4

i) structured interviews using open-ended questions.

ii) on-site observation (direct/indirect)

iii) open-ended/ closed questions.

- (b) Information is available from internal and external sources. Under what circumstances would the analyst depend more heavily on external than internal information? 3 1/2

- (c) As an analyst, how do you gain and maintain rapport with the user's staff? Give an example. 3 1/2

- (d) In COVID pandemic, what kind of electronic information's are available for the analyst? 2 2/2

SECTION : B

20/30

- Q.5 (a) If a new system design is likely to meet user specification, why do users resist change? How would one reduce resistance to change? Explain in detail. 6 4/6

- (b) Suppose you were asked to prepare a plan for training the user staff on a newly acquired micro computer system. 6

i) What factors do you consider in preparing the plan?

ii) How would you design the plan?

iii) What objectives are considered as a basis for the plan?

- Q.6 (a) Consider an ecommerce business model that allows the following features:- 5 3/5

E-commerce is the buying and selling of goods and services over the internet.

It is conducted over computers, tablets, smartphones, and other smart devices.

It can be a substitute for brick and mortar stores, though some businesses choose to maintain both.

Ecommerce operates in four market segments including business to business, business to consumer, consumer to consumer, and consumer to business.

Draw an overall data flow diagram for the application.

- (b) In what way is a decision tree and a decision table related? Explain and illustrate with an example. 4 3/4

- (c) What points should be considered in constructing a data dictionary? 3 2/3

- (a) What is a Gantt chart? How would you develop one? How does it differ from a PERT chart? 4
- (b) Why do you need to conduct risk analysis for system design? When would this type of analysis be cost justified? 4
- (c) Distinguish the following terms: 4
- i) system security and data security.
 - ii) system integrity and data integrity.
- ✓ (d) Design a structure chart using the following information: 8 6/1
- # calling module: RECORD STUDENT GRADES
- # called modules:
- GET ACADEMIC RECORD
- GET VALID GRADES
- ADD NEW GRADES
- REPORT ERRORS
- CHECK FOR PROBATION
- CHECK FOR DEAN'S LIST
- # Include the required input and output couples, showing the direction and meaning.
- # In the same chart, show CHECK FOR PROBATION as a calling module and factor a called module called CALCULATE GPA. Show input and output couples.
- ✓ (e) Discuss the coupling and cohesion according to the resultant structure chart from the above question. 4 2/1

*** Best Wishes ***

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4th Year Odd Semester Examination 2020
COURSE NO: CSE 4117 COURSE TITLE: Parallel and Distributed Processing
FULL MARKS: 72 TIME: 3 HRS

- N.B. (i) Answer any SIX questions taking any THREE from each section.
(ii) Figures in the right margin indicate full marks.
(iii) Use separate answer script for each section.

33/59

SECTION : A

23/32

Marks

- Q.1 (a) Why is it necessary to hide the physical location of a distributed system? Briefly discuss with a suitable example. 4 1/4
- 8/12 (b) Discuss the cases of a distributed mutual exclusion algorithm when a process receives a request message. mention the number of messages required per entry according to this algorithm. 4 1/4
- (c) A centralized system is more cost effective than a distributed system, is it true or false? Define your answer. 4 3/4
- Q.2 (a) Explain the steps of RPC. What are the benefits of RPC? 4 3/4
- 8/12 (b) Mention the key characteristics of multi computer operating systems and also sketch its general structure. 4 2/4
- (c) Consider an Omega switching network with 128 CPUs and memories aiming to perform only read operation. If the instruction execution time is 2 nsec, then find the followings:
i) Number of switching stages from memory to CPU.
ii) Total number of switching stages.
iii) The switching time for each switch.
iv) Total number of switches in the network.
- Q.3 (a) Explain the working principle of μ Torrent. 4 1/4
- (b) Which scaling technique should we apply to make a distributed system geographically scalable? Explain. 3
- (c) Machine X wants to synchronize its physical clock with the time server and so it sends a request message to the server at 10:00:00. Then it receives the reply message from the server at 10:01:30 and according to the reply message the server's time is 10:01:05. Approximate the server's current time [server's time at the point of receiving the reply message] considering the interrupt handling time as 00:00:15. 5
- Q.4 (a) Consider there are 7 processes. If both process 2 and 5 finds that the co-coordinator is not responding, then how will the co-coordinator be selected according to ring algorithm. 4 1/4
- 7/8 (b) Describe the different levels of a three tiered architecture using proper diagram. 4
- (c) Between active replication and primary backup which one would you choose to deal with the following faults [mention the reasons]:
i) Fail silent faults, ii) Byzantine faults. 4 3/4

SECTION : B

10/22

- Q.5. (a) Briefly describe four levels of parallel processing using necessary examples. 4
- (b) Draw the architecture of "Supermini VAX-11/980 uniprocessor system and explain it's different components" 4
- (c) Define symmetric multiprocessor. Write down the characteristics of it. What are the advantages of it? 4
- Q.6 (a) Briefly explain the following terms using suitable figures and examples:
i) SISD, ii) SIMD, iii) MISD, iv) MIMD 8 1/8
- 6/12 (b) Define time shared bus. Write down the advantages and disadvantages of it. 4 2/4
- Q.7 (a) What is cache coherence problem? How directory based protocol works for solving cache coherence problem? 4 1/1
- 2/7 (b) Why passive standby is not considered as perfect clustering methods? 2 2/2
- (c) Draw the block diagram of CC-NumA organization. What are the advantages of it? 3 1/3
- (d) Differentiate between write through and write back strategies for dealing with writes to a cache. 3 0/1
- Q.8 (a) Briefly explain different types of hardware methods to achieve parallelism in uniprocessor system. 6
- 2/3 (b) Briefly explain the following terms:
i) UMa, ii) NumA, iii) Hybrid shared distributed memory. 4 2/2
- (c) Write down the advantages of SMP over uniprocessor. 2 0/1
