Malaviya National Institute of Technology Jaipur

Department of Computer Science and Engineering

Systems Programming (CST-210)

Spring Semester

Max Marks: 40 **End-Term Examination** **Time: 2 hours**

1) ***[5+3+2]***

a) What are the basic 5 motivations behind system programming? Justify each of the points.

b) Draw a diagram showing the step-by-step process of reading an executable file.

c) What is hyper-threading in a CPU? How does it work?

2) ***[3+2]***

a) Explain Indexed addressing mode with proper examples.

b) What is the meaning of the following assembly code: `leal (%edx,%edx,2),%edx`

3) ***[6+1+3]***

a) A **MACRO** expansion, named **INRDCR**, which takes the parameters **INDEV** (input device), **OUT** and **STATUS**. The value of **INDEV** is **0** when the device is NOT ready. The code waits for **INDEV** to be ready, and then reads a Character from it. If the value of **STATUS** is **0** then it should increment the value by **1**, else it should decrease the value by **1**. Finally it should store the value in **OUT** variable. Write the **MACRO** definition for **INRDCR**.

b) Write a code snippet to demonstrate how we can use this MACRO in other code.

c) If a MACRO definition defines another MACRO inside it, then how can it be used in an assembly program? What type of macro processor is best suited for this scenario and why?

4) ***[3+2+3+3+3+1]***

a) Explain how to define and refer records in an object code.

b) What is the structure of a modification record?

c) Suppose you want to compile two c programs "libsharedwork1.c" and "libsharedwork2.c" from which we want to create a shared library **"libsharedwork"** in location **/usr/lib** location. Later, we want to link this library to **"main.c"** to create the final executable. Write the **gcc** commands to do so.

d) What data structures are needed to implement lazy binding?
Where does each of these structures reside in the object code?
What are the contents of these tables?

e) What are the different types of device modules are there in a Kernel? Explain each of them

f) What is policy free driver?

Malaviya National Institute of Technology Jaipur

Department of Computer Science & Engineering

Mid Term – II Examination (Even Semester 2016-17)

FM: 20 **System Programming (CST-210)** **Time: 1Hr**

1. Compare the properties of Macro and Subroutine with pros and cons with respect to the following: *[4]*
   a. Code space requirement
   b. Execution speed
   c. Processing required by the assembler
   d. Flexibility and generality
2. Describe the data-structures needed for Macro processor implementation. Write **struct** format for implementation in C language for all of them. *[3]*
3. Suppose macro A is nested within macro B. We want any program to use A without using B. To facilitate that, how will you include that feature in the preprocessor's algorithm? *[2]*
4. Sometimes, library modules are prepared as non-relocatable codes. What would be the advantages and disadvantages of that? *[2]*
5. Explain how the OS designers should choose between modification record and relocation bit. Support your claim with proper examples. *[3]*
6. In assemble-and-go loaders, each line of an assembly code is assembled and run at a time. Can we use one-pass macro processor with nested macro support for this assembler? If not, then *[1 + 5]*
   a. Give justification to your answer.
   b. Provide a flowchart of a preprocessor for such assemblers. Enlist the limitations of your algorithm clearly.

Note: *1. Write your answers in brief and to the point. Marks may be deducted for unnecessary explanations.*
2. Your copy will be rejected if you are found with mobile phones at the time of examination.

Malaviya National Institute of Technology Jaipur

Department of Computer Science and Engineering

End Term Examination (Even Semester 20116-17)

FM: 50 **System Programming (CST-210)** **Time: 2Hrs**

1. A) Is processing speed of a system enough to evaluate performance of the system? Justify your answer. *[3+1]*
   B) Differentiate between a **process and a thread** with clear examples. *[4]*
   C) If a page, requested by the processor, exists in the virtual memory, but not in the physical memory, how is this request fulfilled? Answer with labelled diagram. *[4]*
2. A) Explain the types of **addressing modes** with proper examples in GAS format. *[4]*
   B) Differentiate (with proper examples) between various instructions for setting condition codes. *[3]*
3. A) Write down the advantages and disadvantages of one-pass and two-pass assemblers. *[2]*
   B) Draw flow charts for a multi-pass macro pre-processor, assuming that a macro body cannot be accessed unless it is expanded. Integrate as many advantages (from previous answer) as possible in your method and write them down. *[6+2]*
4. A) What is a symbol table? What are the types of global symbols and in case of conflicts, how are they used to resolve it by linkers? *[1+3]*
   B) Write and explain the structure of a modification record. *[3]*
5. A) Write a method to modify the device driver of a character device to act as a block device. Also, point out the limitations of your proposed method. *[3+2]*
   B) What are the various methods to tackle reverse engineering attacks on executable codes and what do they try to do? *[3]*
6. Write an NASM Macro that takes one parameter (Byte integer). If it is not a positive integer, it prints an error message. Otherwise, it finds and prints the largest number whose square is smaller than the given parameter. Try to minimize the number of computations required and do not use library methods. *[6]*

Note: ***1. Write all parts of a question in sequence and in same place.*** *Write your answers in brief and to the point. Marks may be deducted for unnecessary explanations.*
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Malaviya National Institute of Technology Jaipur

Department of Computer Science and Engineering

Systems Programming (CST-210)

Mid–II Examination ***Spring Semester***

Max Marks: 20 Time: 1 hour

1) ***[1.5 + 1.5 + 3 + 2]***

a) What are the different types of loaders? Why are there different types of loaders available?

b) In which state of a compute should we use absolute loader? Justify your answer.

c) State the differences between EXTDEF and EXTREF with proper example.

d) What is ESTAB? How is it used in a Loader (you can use your example from question 1.c.)?

2) ***[1 + 3 + 2]***

a) How is Macro expansion different from a subroutine call?

b) State importance (with brief example) for the three data structures required to implement Macro.

c) How many passes are required for a Macro processor to implement all the functionalities? Why?

3) ***[3.5 + 2.5]***

In a multi-pass assembler among its *'n'* number of passes, ***n-1*** passes are comparable to repetition of pass-1, and n^{th} pass is similar to pass-2 of a 2-pass assembler.

a) Draw a flowchart for the ***n-1*** passes of the multi-pass assembler.

b) Draw a flowchart for the n^{th} pass of the multi-pass assembler.

Malaviya National Institute of Technology Jaipur

Mid Term – II Examination (Even Semester 2015-16)

FM: 20 **System Programming (CST-210)** **Time: 1Hr**

1. Consider the possibility of creating a two-pass Macro processor, where, in pass-1 it only checks the Macro definitions and, in pass-2 it simply expands the Macros wherever used. Compare this with a one-pass Macro processor and suggest major advantages and disadvantages. *[3]*
2. **a.** Describe the data-structures needed for Macro processor implementation. *[1.5]*

   b. Consider a macro processor where only one instance of each of the structures are available. What will happen if a macro definition calls another macro inside it? If you suggest any problem, what would be the probable solution to it? *[2.5]*
3. State the differences in usage between modification record and relocation bit, with proper examples. *[3]*
4. Consider a Macro Definition, **MacroX** that computes the volume of either a **Cylinder** ($pi*x^2*y$ = area of a circle *y), or a **Rectangular box** (x*y*z= area of a rectangle *x) and assume that the value of pi is integer **3**.

   a. The macro defines two macros inside it, **Circle** and **Rectangle**.*

   b. The **MacroX** will use/expand only one of these two depending on the requirement.

   c. **MacroX** does not multiply Height with area, rather it uses repetitive additions (using loop) to perform it.

   Write the **MacroX** definition for the above specification. *[3+2+2]*

   Write examples of **MacroX** expansion for both the cases. *[3]*

* These macros calculate the areas of the respective shapes

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Department of Computer Engineering
II MID TERM TEST spring Semester 2014
IV CP – System Programming

Time: 1 Hour Marks: 20 Marks

All questions carry equal marks.

1. Design an Assembler for a hypothetical machine, handling forward and backward reference, Origin, NOOP, EQU, Operation codes like Load, Add, Sub, Mul, Div, jump (with all logical operators like GT, LT..). Justify other necessary information used in designing this assembler. |5|

2. Justify the below statements as true and false : |5|
   a. An instruction cannot change the value of a literal.
   b. An absolute loader performs loading process and need to perform linking and program relocation processes.
   c. Program Relocation, Program Linking, Linking loader algorithm are machine dependent loader features.
   d. Self-relocating programs are less efficient than relocatable programs.
   e. The loading process requires more instructions that can be read in a single record, this first record causes the reading of others, and these in turn can cause the reading of still more records.

3. What is Binary program? How it is created? Explain with necessary diagram and its algorithm. |5|

4. What is an address sensitive instruction? What is Dynamic Link Library? What are the advantages of dynamic linking? |1,2,2|

Department of Computer Engineering
I MID TERM TEST spring Semester 2014
IV CP – System programming

Time: 1 Hour Marks: 20 Marks

All questions carry equal marks.

1. What is a macro processor? Give the algorithm and data structures for a one pass macro processor.
2. What are the characteristics of system software that differentiate it from application software? Give names of 6 system software with their functions.
3. What is macro invocation statement? What are conditional, keywords and positional parameter? Explain.
4. Write a macro that moves n numbers from first parameter to second parameter, where n is specified as third parameter of the macro. Write names of 5 assembly language directives with their functions?
5. Compare and Contrast the properties of macros and subroutines with respect to the following:
   (a) Code space requirement
   (b) Execution speed
   (c) Processing required by the assembler
   (d) Flexibility and generality.

Malaviya National Institute of Technology Jaipur

Mid-Term Examination - I **(Even Semester 2016-17)**

FM: 20 **System Programming (CST-210)** **Time: 1Hrs**

1. (a) What is a BUS? What should be the minimum and maximum number of connectors in a BUS and why?
   b) What are the major BUSes inside a computer system? Specify each of their features with justifications. ***(2+4)***

2. a) Explain the structure of cache memory for ***Intel i7*** processors with a neat figure.
   b) Explain the purposes of the different cache memories. ***(2+3)***

3. a) Why is a memory-map required in case of virtual memory?
   b) How is hyper-threading implemented in a processor? ***(1.5+1.5)***

4. Write NASM assembly code that takes an integer through ARGV[] then it prints a number triangle using **loops** as follows: If the given integer is ***5***, then it should print – ***(6)***

```
5 4 3 2 1
5 4 3 2
5 4 3
5 4
5
```

Note: *1. **Write all parts of a question in sequence and in same place.** Write your answers in brief and to the point. Marks may be deducted for unnecessary explanations.*
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Malaviya National Institute of Technology Jaipur

End Term Examination **(Even Semester 2015-16)**

FM: 50 **System Programming (CST-210)** **Time: 2Hrs**

1. A) Compare (in tabular format) the Cache memories used in different levels in a processor. *[3]*
   B) What is a hardware thread?
   What are the advantages of it over software threads? *[4]*
   C) What are types of Addressing modes? Explain with example. *[3]*

2. A) What type of instruction sets require decoding instructions to Uops?
   What will happen if a processor does not have Out-of-Order engine along with Uop-sequencer? *[1+3]*
   B) Explain following instructions with examples: i) **cltd** ii) **idivl** iii) **testl** *[2x3]*

3. A) What is Jump table? In what situation does jump table incur efficient implementation? Justify your answer with example. *[5]*
   B) What are the challenges of designing general purpose macro processors? *[2]*
   C) How does a linker define and refer to symbols in (i) assembly format and (ii) object code? *[1+2]*

4. A) What is a policy-free driver? What are the major types of devices? Explain the differences between Network and Block devices. *[1+1+1]*
   B) What is the difference between Paging and Segmentation? If paging is used, how can a logical address be translated to a physical address? *[2+3]*

5. A) Consider the number sequence 1, -3, 6, -10, 15, -21, 28, -36... Write a Macro Definition Quadr that will calculate the next number in the series while given the required inputs. Write an assembly program to generate the sequence using the above macro. *[4+4]*
   B) Assume that the following code checks the password (using **"!(strcmp)"**), and jumps to a specific location if the password matches. List all possible changes that will bypass/omit password checks with justification.

```
"testl    %eax, %eax
 jne      .L2    "
```

[4]

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Department of Computer Engineering
END TERM Examination spring Semester 2014
CST210 IV CP – System Programming

Time: 2 Hours **Marks: 50**

1. Attempt any four. Justify (with one suitable example of each) the statement as true or false:
   I. The call by value parameter passing mechanism cannot produce side effects.
   II. During code optimization, a compiler may rearrange the computations in a program.
   III. A program that does not contain forward references can be translated in a single pass.
   IV. The java language environment supports portability of programs.
   V. Programs can be loaded and executed at specific addresses without any "kernel".

   [3,3,3,3]

2. (i) If elements of a two dimensionality array are allocated in a column wise (instead of row wise) manner, devise the address calculation formula for access to an array element.
   (ii) Why use of static binding leads to more efficient execution of program than use of Dynamic binding?
   (iii) What are different phases of compiler? Explain with below statement of code.
   Amount_to_be_paid = Principal + 0.15* Time [2,3,5]

3. (i) What is a software tool? What should be essential steps in program development? [2,3]
   (ii) How is the loader itself loaded into memory? [2]
   (iii) '*What you see is what you get* 'principle is used in which text editor? Give one example in support of this? [2,1]

4. (i) Differentiate between word processor and structure text editor? [4]
   (ii) What is role of User Interface and its functionalities? [4]
   (iii) A real time operating system is used to implement a computer application for controlling or tracking of real world activities. To facilitates this, what does OS permits a user? [2]

5. (i) What are facilities for dynamic debugging by Debug monitors?
   (ii) Dynamic debugging is easier to implement in interpreters than in compilers. How? [4,4]

Department of Computer Engineering
END TERM Examination spring Semester 2014
CST210 IV CP – System Programming

Time: 2 Hours **Marks: 50**

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