

BENGAL ENGINEERING & SCIENCE UNIVERSITY, SHIBPUR
BE (CST) PART III 6th SEMESTER EXAMINATION, 201(1
Systems Programming (CS 605)

F.M: 70

Time: 3 hrs.

- Answer your questions in a single answer script.
- Answer any 6 questions taking at most 3 from each group.
- 2 marks are reserved in each group for neatness.

GROUP A

1. a) What is a forward reference? What is its implication in the design of an assembler?
b) What are the mandatory fields of an MOT? Give justification for each of these fields and additional fields, if any, which may reduce the assembler code.
c) Did you incorporate the mnemonics for all available instructions in the machine op-code table? Discuss the advantages and disadvantages. [4 + 4 + 3]
2. a) What do you mean by relocation and symbol resolution? Explain with example.
b) What is a static library? What is the format of a typical static library? Considering two source files f1.c and f2.c write the steps and commands needed to form a static library in a LINUX system. [6 + 5]
3. a) What are the five usual sections that can be found in most of the object files produced by the assembler/compiler? Describe those sections.
b) What are the tasks of a linker in its different passes. [5 + fi]
4. a) What is PIC? Why is it necessary for a shared library? What are the advantages and disadvantages of a shared library?
b) Show with a neat diagram that in ELF the data references can be made PIC easily at the cost of some extra instruction due to a typical load time properties of ELF executable. [6 + 5]
5. Write short notes on (any two)
 - i) Relocatable ELF object file.
 - ii) Implications of alignment; word and page.
 - iii) INTEL 8 bit hex object file.

GROUP B

6. a) Four functions and their text, data and bss requirements are given in the following table. Assuming the load address of 0x2000, 4-byte alignment and a 4Kb page size calculate and show the memory layout of the functions linked together in a tabular form.

Function	<u>text</u>	<u>data</u>	<u>bss</u>
maiii	0x2345	0x143	0x1AF
fA	0x3BC4	0x531	0x2310
fB	0x212C	0x78	0x47E
fC	0x34	0x12	0x23F

- b) What are the rules used by the linker to resolve multiply defined global symbols? [8 + 3]

7. a) What do you mean by loading, relocation and symbol resolution? Explain with example. What could be the problem if there is no fixed format for the object files in a system?
- b) Write two functions (addXY and multXY); one for adding and the other for multiplying two integers, respectively. The functions returns the computed values as usual to the caller. Put the functions in a static library. Write a main function and call the functions from the library to add and multiply two integers and print the values. Write all the necessary commands to generate object files; creating the library, linking the main function with the library and finally commands to execute the main program.
8. a) Examine the following two source files which have been linked together to create an executable.

```

/* f5.c */
#include <stdio.h>
int x = 15213;
int y = 15212;
int main()
{
    fC);
    printf("x=0x7,x y=0x*/.x\n", x, y);
    return 0;
}
>
/* b5.c */
double x;

void f()
{
    x = -0.0;
}

```

What would be the output of this program? Give appropriate reason for the output that you predict. Also, make a minimum change in b5.c file (without changing the variable name and type) so that you get the true values of x and y of f5.c in the output in their hexadecimal form.

b) Consider *a* and *b* as two object modules (or static libraries) in the current directory. Also, assume that *a* → 6 denotes that *a* depends on *b*, in the sense that *b* defines a symbol that is referenced by *a*. For each of the following scenarios, show the minimal command line (i.e., one with the least number of file, object file and library arguments) that will allow a static linker to resolves all symbol references.

(i) *p.o* —* *libx.a*

(ii) *p.o* —* *libx.a* —» *liby.a*

(iii) *p.o* —» *libx.a* —»*liby.a* and *liby.a* —• *libx.a* —* *p.o*

[5 + 6]

9. a) What are the functions available for loading and linking dynamic libraries from an application? Describe each of them with the details of the parameters required and the type and value, if any, returned by these functions.

b) Draw the LINUX run time memory image of any program. Clearly show the R/O segment, R/W segment, run time heap area, memory mapped region for the shared libraries, stark and the kernel virtual memory.

[7 + 4]

10. Write short notes on (any two)

[5j x 2]

- i) Tools for manipulating object files.
- ii) DOS com format.
- iii) ELF format.