

OS 2021 Problem Sheet #6

Problem 6.1: scheduling strategies

(4+2 = 6 points)

A computer system with a single CPU has to execute six processes A, \dots, F . The arrival times and the execution times of the processes are given by the following table.

process	arrival time	execution time
A	0	9
B	4	8
C	6	2
D	8	5
E	13	4
F	15	1

- Draw the schedule for the scheduling strategies first-come first-served (FCFS), shortest processing time first (SPTF), longest processing time first (LPTF), and round robin (RR) with a time slice of 1 time unit. Assume that arrivals happen before a scheduling point and that new processes are added at the end of the run queue.
- For each schedule, calculate the average turnaround time \bar{t} and the average waiting time \bar{w} .

Problem 6.2: linking

(2+1+1 = 4 points)

The following C source files are compiled separately into object files and afterwards linked with other object files into an executable.

```

/* a.c */
#include <stdio.h>

extern int x;
int y;

static void f()
{
    static char z = 'Z';
    puts("a.c: f()");
}

void g()
{
    puts("a.c: g()");
    f();
}

/* b.c */
#include <stdio.h>

extern void g();

int x = 1;
static double y = 1;
static char z = 'A';

void f()
{
    puts("b.c: f()");
    g();
}

```

- Which symbols defined in the files `a.c` and `b.c` are
 - internally defined symbols not accessible outside of the object file,
 - references to externally defined symbols that must be resolved by the linker,
 - weak linkable symbols defined in the object file, or
 - strong linkable symbols defined in the object file?

Mark the corresponding cell in the following table (we ignore the `puts` symbol).

file	symbol	internal unlinkable symbol	reference of external symbol	weak linkable symbol	strong linkable symbol
a.c	x				
a.c	y				
a.c	z				
a.c	f				
a.c	g				
b.c	x				
b.c	y				
b.c	z				
b.c	f				
b.c	g				

b) What will be printed to the standard output by the following `main()` function? Explain.

```

/* main.c */

extern void f();

int main()
{
    f();
    return 0;
}

```

c) What is name mangling and why do programming languages like C++ use name mangling? Why do I sometimes need to use `extern "C" {}` in C++ header files?