1st Midterm Exam

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I. Single Choice (2 points/question)

1. Which one of the following is not shared by threads?

a) codes

b) stack

c) both codes and stack

d) none of the mentioned

2. The time required to create a new thread in an existing process is

a) greater than the time required to create a new process

b) less than the time required to create a new process

c) equal to the time required to create a new process

d) none of the mentioned

3. Given the following program:

```
int r1 = alarm(5);
printf("r1 = %d\n", r1);
int r2 = alarm(6);
printf("r2 = %d\n", r2);
```

what are the values of r1 and r2?

a) r1=5, r2=6;

b) r1=0, r2=5;

c) r1=5, r2=0;

d) r1=0, r2=6;

4. Given the following program:

```
void* thread_run(void* para)
{
 printf("This is created thread");
 return NULL;
}
main()
{
 pthread_t tid
 pthread_create(&tid, NULL, thread_run, NULL)
 printf("This is main thread");
return 0;
}
```

What is the output?

a) "This is created thread"

b) "This is main thread"

c) "This is main thread" + "This is created thread"

d) none of the mentioned

5. The program in Q4 may create:

a) an orphan process

b) a zombie process

c) a zombie thread

d) an orphan thread

6. The kernel is _____ of user threads when the user-level thread management is applied.

a) a part of

b) the creator of

c) unaware of

d) aware of

7. The following program

```
main()
{
  if(fork()>0)
  {sleep(50);}
  return 0;
}
```

will finally result in the creation of:

a) an orphan process for 50s

b) a zombie process for 50s

c) a zombie process forever

d) an orphan process forever

8. If execve() is called immediately a process after fork(),

a) the function/process specified in the parameter of execve will replace the entire process

b) the child process just duplicates its parent process

c) the parent process just duplicates its child process

d) none of the mentioned

9. Which one of the following could be a way of sending a signal to a process?

a) using keyboard to press some special key combinations

b) using shell command to send signal

c) using some system call functions

d) all of the mentioned

10. Which one of the following is NOT a type of operating system?

a) Multiprogramming OS

b) Time sharing OS

c) Batch processing OS.

d) Multiprocessing OS

11. Which of the following is not the methods to achieve inter process communications?

a) shared memory.

b) unamed pipe.

c) message caching

d) signals

12. Which of the following signals cannot be caught?

a) SIGTSTP

b) SIGSTOP

c) SIGINT

d) SIGSYS

13. Which of the following function is not considered as a system call?

a) open()

b) write()

c) fork()

d) return

14 Which of the following statements is not correct?

a) pipe() is considered as a type of message passing to achieve inter-process communications.

b) pipe() can only achieve the communications between a parent process and its child processes.

c) If a process attempts to write to a full pipe, it will be blocked

d) If a process attempts to read from an empty pipe, it will not be blocked. Instead, the process will receive a NULL value.

15. Given the following program

```
int main(){
  pid_t pid;
  int i = 10;
  pid = fork();
  if(pid == 0){
    i += 50;}
  else{
  i += 100;}
  printf("i=%d\n", i);
 return 0;}
```

what is the output?

a) i=110; i=60;

b) i=60;

c) i=110;

d) i=160;

16. Given the following program

```
int main(void)
{  pid_t pid;
  pid = fork();
  if (pid == 0)
  {
     int i;
     for (i = 3; i > 0; i--)
     {
        sleep(1);
     }
     exit(5);
  }
  else
  {  int stat_val;
     waitpid(pid, &stat_val, 0);
     if (WIFEXITED(stat_val))
     {printf("Child exited with code %d\n",
WEXITSTATUS(stat_val));
     }
     else if (WIFSIGNALED(stat_val))
     {printf("Child terminated abnormally,
signal %d\n", WTERMSIG(stat_val));
     }
  }
  return 0;}
```

what is the output?

a) Child exited with code 0;

b) Child exited with code 5;

c) Child terminated abnormally, signal 0;

d) Child terminated abnormally, signal 5;

17. What is a way to kill a zombie process (assuming the parent process is not terminated).

a) Send SIGKILL to the Zombie process

b) Send SIGKILL to the Zombie's parent process

c) The system will automatically kill the Zombie process. So, no action is needed.

d) Send SIGINT to the Zombie process

18. Given the following program

```
void sighandler(int sig) {
printf("this is in the sig handler\n");}

int main() {
 struct sigaction act;
 sigaddset(&act.sa_mask, SIGSTOP);
 act.sa_handler = sighandler;
 act.sa_flags = 0;
 sigaction(SIGSTOP,&act,0);
 pid_t pid = getpid();
 kill(pid, SIGSTOP);
 printf ("this is the main function\n");
 return 0;}
```

what is the output?

a) this is in the sig handler;

b) this is the main function;

c) this is in the sig handler

this is the main function;

d) No output;

19 Which of the following statements is not correct?

a) Shared memory can achieve the communications between two processes.

b) Before a process accessing a shared memory segment, the shared memory segment has to be attached to the process by invoking shmat().

c) Shmget() is used obtain the ID of the existing shared memory segment.

d) Shm_create() is used to create a shared memory segment.

20. Which of the following function is not implemented by medium-term scheduler is used to

a) remove processes from the memory to the disk;

b) bring processes in the disk back to the memory;

c) adjust the degree of multiprogramming;

d) determine which process in the ready queue should be executed by the CPU.

II. Fill in the blank (2 points/blank)

1. Strace command is used to trace system calls made by a process, and ltrace command is used to trace library function calls made by a process.

2. Press "Ctrl-C" is used to send SIGINT signal to the running process.

3. Please fill in the blank in the following program to obtain the user time and system time (***measured in microsecond***) of the "for" loop.

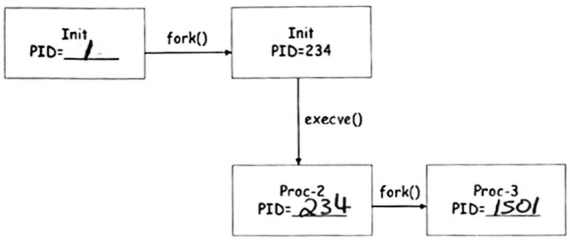
```
int main(int argc, char** argv){
 double dum, usertime, systime;
 struct rusage r;
 struct timeval user_start, sys_start, user_end,
sys_end;

 getrusage(RUSAGE_SELF, &r);
 user_start=r.ru_utime;
 sys_start=r.ru_stime;
     for(int i = 0; i < 100000000; i++)
     {dum=i*exp(0.5)+i;}
 getrusage(RUSAGE_SELF, &r)
 user_end=r.ru_utime;
 sys_end=r.ru_stime;
 usertime
=(u_end.tv_sec*1000000+u_end.tv_usec)-
 systime (u_start.tv_sec*1000000+u_start.tv_usec);
=(s_end.tv_sec*1000000+s_end.tv_usec)-
 printf("User time: %fus\n", usertime);
 printf("System time: %fus\n", systime);
 return 0;
}
 (s_start.tv_sec*1000000+s_start.tv_usec);
```

4. Please fill in the blank in the following program to achieve pipe communications, where the parent process writes "Hello, midterm exam!" to the pipe, and the child process reads the contents from the pipe.

```
char msg1[20] = "Hello, midterm exam!";
main() {
char inmsg[20]; int pipedes[2]; pid_t pid;
if (pipe(pipedes) < 0)
{ perror("pipe call failure"); exit(1); }
 switch (pid=fork()) {
 case -1: perror("fork call failure"); exit(2);
 case 0:
        read(pipedes[0], inmsg, sizeof(msg1));
        printf("%s\n",inmsg);break;
 default:
        write(pipedes[1], msg1, sizeof(msg1));
        wait(NULL); break;
 }
}
```

5. Please fill in the PID values



III. General Questions

1. What is the output of the following program being executed? Assume that there is only one CPU available for running the program. (6p)

```
int g = 5;

void *myThreadFun(void *varp)
{
   int *myid = (int *)varp;
   static int s = 3;
   ++s; ++g;
   printf("Thread ID: %d, Static: %d, Global: %d\n", *myid, ++s, ++g);
   return NULL; }

int main()
{
   int i, j;
   pthread_t tid[3];
   for (i = 0; i < 3; i++) {
      pthread_create(&tid[i], NULL, myThreadFun, (void *)&i);}
   for (j=0; j<3; j++) {
      pthread_join(tid[j], NULL);}
   return 0; }
```

Thread ID: 0, static: 2, Global: 2

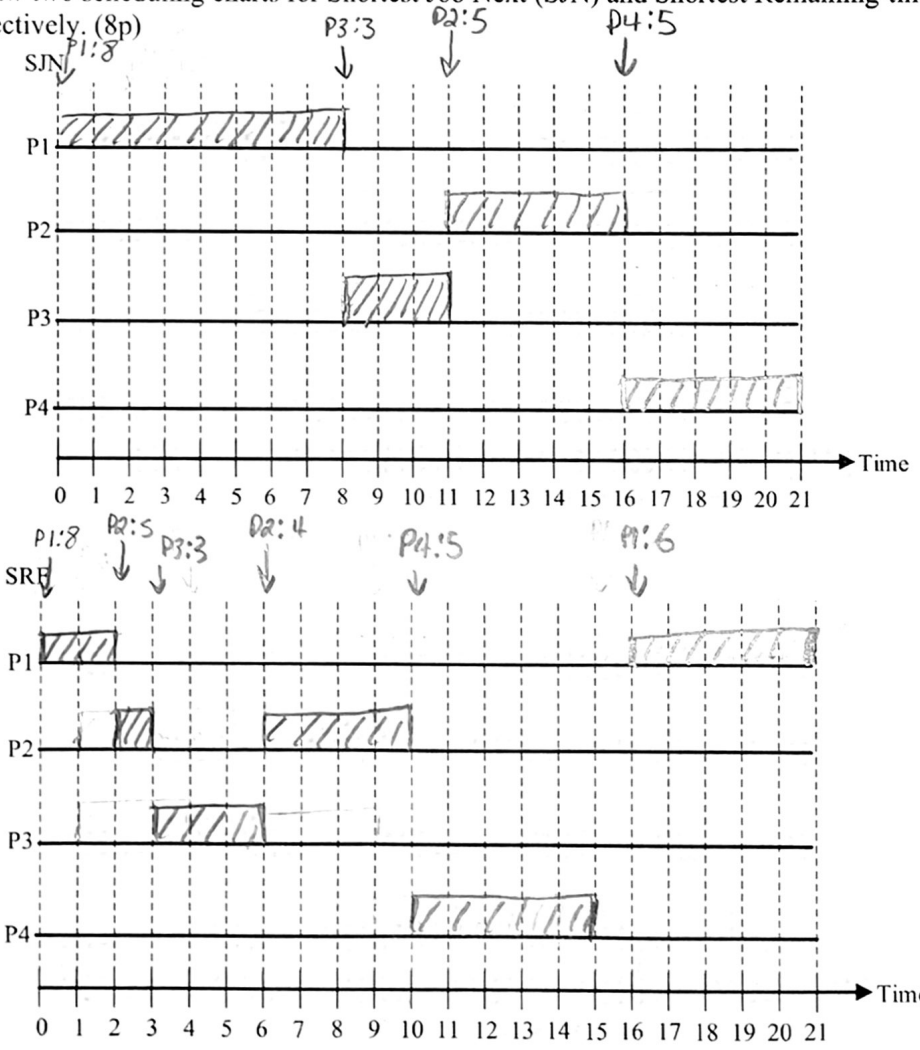
Thread ID: 1, static: 4, Global: 4

Thread ID: 2, static: 6, Global: 6

2. Assume that there are four processes, and the information of these four processes are as follows:

	Arrival time	Service time
P1	0	8
P2	2	5
P3	3	3
P4	5	5

a) Please draw two scheduling charts for Shortest Job Next (SJN) and Shortest Remaining-time First (SRF), respectively. (8p)



b) Please calculate the average waiting time of a process for applying SJN and SRF, respectively. Provide one pro and one con of SRF as compared to SJN (8p).

wt = waiting time

SJN:

wt(P1) = 0
wt(P2) = 9
wt(P3) = 5
wt(P4) = 11

$= \frac{(0+9+5+11)}{4}$

$= 6.25$

SRF:

wt(P1) = 14
wt(P2) = 3
wt(P3) = 0
wt(P4) = 5

$= \frac{(14+3+0+5)}{4}$

$= 5.5$

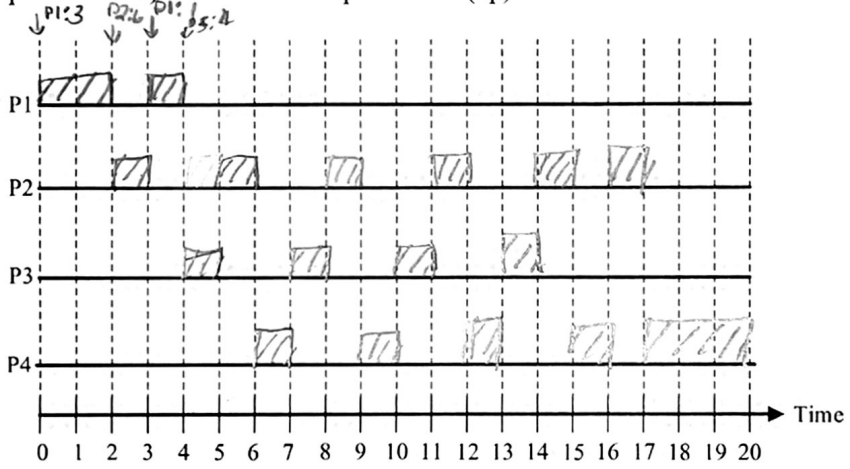
Pro to SRF: Quicker computing time

Con to SRF: More possible overhead when switching.

3. Assume that there are four processes, and the information of these four processes are as follows:

	Arrival time	Service time
P1	0	3
P2	2	6
P3	4	4
P4	5.9	7

a) Please fill out the following scheduling chart if the round robin (RR) method is applied (where the length of a time quantum is 1) to schedule the processes. (4p)



b) In which time slots that context switches are conducted in the above process scheduling? (4p)

Timeslots: 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17

c) Please modify the setup of the RR method in the example to reduce the number of context switches. Demonstrate the performance (i.e., the number of context switches) of your solution based on the above example. (6p)