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NPTEL (https://swayam.gov.in/explorer?ncCode=NPTEL) » Operating System Fundamentals (course)

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Course outline

About NPTEL ()

How does an NPTEL online course work? ()

Week 0 ()

Week 4 : Assignment 4

The due date for submitting this assignment has passed.

Due on 2024-08-21, 23:59 IST.

Assignment submitted on 2024-08-18, 15:26 IST

1) What is the purpose of a context switch in an operating system? ***1 point***

○ (A) Allocate memory to a new process

○ (B) Deallocate the memory from a process

● (C) Save and restore the state of a process to allow multitasking

○ (D) Terminate a process

○ (E) Initialize a new process in the ready queue

Week 1 ()

Week 2 ()

Week 3 ()

Week 4 ()

○ Lecture 16 : Processes (Contd.) (unit?unit=41&lesson=42)

○ Lecture 17 : Processes (Contd.) (unit?unit=41&lesson=43)

○ Lecture 18 : Processes (Contd.) (unit?unit=41&lesson=44)

○ Lecture 19 : Threads (unit?unit=41&lesson=45)

○ Lecture 20 : Threads (Contd.) (unit?unit=41&lesson=46)

○ Lecture Materials (unit?unit=41&lesson=47)

○ Feedback for week 4 (unit?unit=41&lesson=48)

● **Quiz: Week 4 : Assignment 4 (assessment?name=178)**

Yes, the answer is correct.
Score: 1

Accepted Answers:
(C) Save and restore the state of a process to allow multitasking

2) Which of the following system call is used to replace the current process image with a new process image. ***1 point***

○ (A) fork()
● (B) execl()
○ (C) exit()
○ (D) wait()
○ (E) sleep()

Yes, the answer is correct.
Score: 1

Accepted Answers:
(B) execl()

3) What is the outcome of the following program? ***1 point***

```
#include <unistd.h>
#include <stdio.h>
#include <stdlib.h>
int main()
{
if (execlp("ls", "ls", "-l", NULL) == -1)
{
    perror("execlp");
    exit(EXIT_FAILURE);
}
 printf("This line should not be reached\n");
 return 0;
}
```

● (A) The outcome is exactly same as the outcome of ls -l command
○ (B) The outcome is exactly same as the outcome of ls command

○ Assignment 4 Solution (unit? unit=41&lesson=120)

Week 5 ()

Week 6 ()

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○ (C) The outcome is exactly same as the outcome of ls -a command

○ (D) The outcome is exactly same as the outcome of ls -h command

○ (E) The outcome is exactly same as the outcome of ls -t command

Yes, the answer is correct.
Score: 1

Accepted Answers:
(A) The outcome is exactly same as the outcome of ls -l command

4) How many processes will be created by the following program? ***1 point***

```
#include <unistd.h>
#include <stdio.h>
#include <stdlib.h>
int main()
{
int n;
for(i=1;i<=n; i=i*2)
{
   fork();
}
 return 0;
}
```

○ (A) n

● (B) n^2

○ (C) $\log_2 n$

○ (D) $n\log_2 n$

○ (E) $\sqrt{n}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
(A) n

5) Choose the invalid option. ***1 point***

○ (A) The OS executes exit() system call when the process completes its execution successfully

○ (B) The OS executes exit() system call when the user explicitly requests the termination of the process

○ (C) The OS executes exit() system call when the parent process decides to terminate a child process

● (D) The OS executes exit() system call when the process decided to enter into waiting state

○ (E) The OS executes exit() system call when the process encounters an unrecoverable error or exception

Yes, the answer is correct.
Score: 1

Accepted Answers:
(D) The OS executes exit() system call when the process decided to enter into waiting state

6) Choose the invalid option. The wait() system call **_1 point_**

○ (A) makes the parent process wait until all of its child processes have terminated

○ (B) returns the process identity of the terminated child process

○ (C) allows the parent process to retrieve the exit status of the terminated child process

● (D) is used by a child process to wait for its parent process to terminate

○ (E) The wait() system call is used to prevent the creation of zombie processes

Yes, the answer is correct.
Score: 1

Accepted Answers:
(D) is used by a child process to wait for its parent process to terminate

7) Choose the incorrect option. The pipe() system call **_1 point_**

○ (A) is used to create a unidirectional communication channel between processes

○ (B) returns two file descriptors, one for reading and one for writing

● (C) can be used for inter-process communication between unrelated processes

○ (D) allows data to flow from the read end to the write end of the pipe

○ (E) is typically used for communication between a parent process and its child process

No, the answer is incorrect.
Score: 0

Feedback:

Accepted Answers:
(D) allows data to flow from the read end to the write end of the pipe

8) Which of the following is not directely supported by thread? ***1 point***

● (A) degree of multiprogramming
○ (B) system throughput
○ (C) multiprocessor arctitecture
○ (D) easy resource sharing
○ (E) lower context context switching

Yes, the answer is correct.
Score: 1

Accepted Answers:
(A) degree of multiprogramming

9) A multiprocessor system ***1 point***

○ (A) supports parallel execution of instructions through multithreading
● (B) allows multiple processes to execute asynchronously
○ (C) is suitable for executing strictly sequential processing tasks efficiently
○ (D) allows multiple processes run independently
○ (E) allows interprocess communication among independent processes

No, the answer is incorrect.
Score: 0

Accepted Answers:
(C) is suitable for executing strictly sequential processing tasks efficiently

10) Which of the following system calls is not related to the shared memory interprocess communication? ***1 point***

○ (A) shmget()
○ (B) shmat()
○ (C) shmdt()
○ (D) shmctl()
● (E) shmext()

Yes, the answer is correct.
Score: 1

Accepted Answers:
(E) shmext()

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Course outline

About NPTEL ()

How does an NPTEL online course work? ()

Week 0 ()

Week 5 : Assignment 5

The due date for submitting this assignment has passed.

Due on 2024-08-28, 23:59 IST.

Assignment submitted on 2024-08-25, 23:02 IST

1) Assume we are running an application on a system with four processing cores. This application has both serial (nonparallel) and parallel components. Also, assume that 60% of this application are executed in parallel and 40% of the application is executed in serial. Based on the Amdahl’s Law, this application gets a speedup (approx.) of ***1 point***

○ (A) 1.30 times

○ (B) 1.42 times

○ (C) 1.25 time

● (D) 1.81 times

Week 1 ()

Week 2 ()

Week 3 ()

Week 4 ()

Week 5 ()

○ Lecture 21 : Threads (Contd.) (unit?unit=49&lesson=50)

○ Lecture 22 : Threads (Contd.) (unit?unit=49&lesson=51)

○ Lecture 23 : Threads, Scheduling (unit?unit=49&lesson=52)

○ Lecture 24 : Scheduling (unit?unit=49&lesson=53)

○ Lecture 25 : Scheduling (Contd.) (unit?unit=49&lesson=54)

○ Lecture Materials (unit?unit=49&lesson=55)

○ Feedback for week 5 (unit?unit=49&lesson=56)

● **Quiz: Week 5 : Assignment 5**

○ (E) 1.20 times

Yes, the answer is correct.
Score: 1

Accepted Answers:
(D) 1.81 times

2) The many-to-one multithreading model supports **_1 point_**

○ (A) Many user-level threads only
○ (B) Many kernel-level threads only
○ (C) One user-level thread and many kernel-level threads
● (D) Many user-level threads and one kernel-level thread
○ (E) Many user-level threads and many kernel-level threads

Yes, the answer is correct.
Score: 1

Accepted Answers:
(D) Many user-level threads and one kernel-level thread

3) Which is of the following multithreading model is unsuitable for multicore systems? **_1 point_**

● (A) Many-to-one
○ (B) One-to-one
○ (C) Many-to-Many
○ (D) One-to-Many
○ (E) Many-to-Partial

Yes, the answer is correct.
Score: 1

Accepted Answers:
(A) Many-to-one

4) Which of the multithreading model blocks the entire process if a thread, which is a part of the process, makes a blocking system call? **_1 point_**

○ (A) Many-to-Many

(assessment? name=181)

○ Assignment 5 Solution (unit? unit=49&lesson=121)

Week 6 ()

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● (B) Many-to-one

○ (C) Many-to-Partial

○ (D) One-to-Many

○ (E) One-to-one

Yes, the answer is correct.
Score: 1

Accepted Answers:
(B) Many-to-one

5) Which of the following operating systems does not support the Many-to-Many multithreading model? ***1 point***

○ (A) Solaris

○ (B) HP-UX

○ (C) Tru64 UNIX

○ (D) IRIX

● (E) Windows 11

Yes, the answer is correct.
Score: 1

Accepted Answers:
(E) Windows 11

6) Which system calls allow the calling thread to wait for another thread to terminate? ***1 point***

○ (A) pthread_create

○ (B) pthread_exit

● (C) pthread_join

○ (D) pthread_detach

○ (E) pthread_wait

Yes, the answer is correct.
Score: 1

Accepted Answers:
(C) pthread_join

7) Which of the following statements about non-preemptive scheduling is NOT true? **1 point**

○ (A) Once a process starts executing, it runs to completion before another process can begin.
○ (B) It is simpler to implement compared to preemptive scheduling.
○ (C) It can lead to longer waiting times for processes with short burst times.
● (D) It allows the operating system to preempt a running process to give CPU time to a higher-priority process.
○ (E) It is commonly used in batch-processing systems.

Yes, the answer is correct.
Score: 1

Accepted Answers:
(D) It allows the operating system to preempt a running process to give CPU time to a higher-priority process.

8) Which of the following is not the task of the dispatcher? **1 point**

○ (A) A Dispatcher saves the context (state) of the currently running process.
○ (B) A Dispatcher restores the context of the next process to run.
○ (C) A Dispatcher helps to switch the CPU mode between user mode and kernel mode.
● (D) A Dispatcher manages the main memory for process scheduling.
○ (E) A dispatcher provides the control of the CPU to that process that gets selected by the short term-scheduler.

Yes, the answer is correct.
Score: 1

Accepted Answers:
(D) A Dispatcher manages the main memory for process scheduling.

9) Choose the correct option for FCFS scheduling algorithm. **1 point**

○ (A) It ensures the shortest average waiting time.
● (B) It is suffered from the convoy effect.
○ (C) It is a preemptive scheduling algorithm.
○ (D) It guarantees maximum throughput.
○ (E) It uses a priority queue to manage processes

Yes, the answer is correct.

Score: 1

Accepted Answers:
(B) It is suffered from the convoy effect.

10) Which of the following is not a criterion used to evaluate CPU scheduling algorithms? ***1 point***

- ○ (A) Throughput
- ○ (B) Response time
- ● (C) Memory usage
- ○ (D) Turnaround time
- ○ (E) Waiting time

Yes, the answer is correct.
Score: 1

Accepted Answers:
(C) Memory usage

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About NPTEL ()

How does an NPTEL online course work? ()

Week 0 ()

Week 1 ()

Week 2 ()

Thank you for taking the Week 6 : Assignment 6.

Week 6 : Assignment 6

Your last recorded submission was on 2024-08-29, 18:16 IST

Due date: 2024-09-04, 23:59 IST.

1) Assume that the following processes are scheduled using the Shortest-Job-First process scheduling policy. Determine the average waiting time. ***1 point***

Process	Arrival time	Burst time
P_1	1	3

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P_2	0	2
P_3	3	2
P_4	2	4

● (A) 3.5
○ (B) 2.5
○ (C) 1.5
○ (D) 4.5
○ (E) 0.5

2) Choose the correct statement about "Exponential Averaging" when predicting the next CPU burst length in SJF scheduling. ***1 point***

○ (A) Exponential Averaging gives equal weight to all past CPU bursts.
○ (B) Exponential Averaging discards all previous history when predicting the next burst length.
● (C) Exponential Averaging gives more weight to the recent CPU bursts while still considering the entire history.
○ (D) Exponential Averaging is only applicable to non-preemptive scheduling algorithms.
○ (E) Exponential Averaging requires a fixed-size queue to store past burst lengths.

3) The following processes are scheduled using the Robin process scheduling policy with a time quantum of 3ms. Determine the average waiting time. ***1 point***

Process	**Arrival time**	**Burst time**
P_1	0	6

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X

(assessment? name=182)

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P_1	1	2
P_3	3	8
P_4	5	3
P_5	2	4

● (A) 5.6
○ (B) 8.6
○ (C) 7.6
○ (D) 4.5
○ (E) 6.6

4) Assume the following processes are scheduled using the Priority Scheduling process scheduling algorithm. Determine the average waiting time. Assume a lower value in priority means higher priority. ***1 point***

Process	Priority	Burst time	Arrival time
P_1	2	2	0
P_1	1	3	0
P_3	3	5	0
P_4	5	7	0

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X

P_5	4	4	0

● (A) 6.4
○ (B) 5.0
○ (C) 6.8
○ (D) 5.8
○ (E) 5.2

5) Which of the following process scheduling algorithms does not suffer from the starvation problem? ***1 point***

○ (A) Shortest Job First (SJF)
○ (B) Priority Scheduling
○ (C) Shortest Remaining Time First (SRTF)
● (D) First-Come First-Served (FCFS)
○ (E) Multilevel Queue Scheduling

6) The "Progress" condition in the context of the Critical Section Problem refers ***1 point***

● (A) If no process is in the critical section and some processes wish to enter it, the selection of the next process must not be indefinitely postponed.
○ (B) Only one process can be in the critical section at a time.
○ (C) No process should wait forever to enter the critical section.
○ (D) If a process is in the critical section, no other process can enter until it has finished.
○ (E) Processes must be allowed to enter the critical section based on their priority.

7) The “race condition” in the context of the critical section problem ***1 point***

● (A) occurs when multiple processes enter their critical sections simultaneously, leading to unpredictable results.
○ (B) happens when a process is forced to wait indefinitely before entering its critical section.
○ (C) arises when the OS fails to schedule processes fairly.
○ (D) refers to the situation where two or more processes compete for CPU.

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○ (E) is a condition where a process preempts another process in the middle of its critical section.

8) The solution to the critical section problem ensures which of the following(s)? ***1 point***

○ (A) Mutual exclusion
○ (B) Progress
○ (C) Bounded waiting
○ (D) Mutual Exclusion and Progress
● (E) Mutual exclusion, Progress, and Bounded waiting

9) Consider the producer-consumer problem with a bounded buffer. The processes share a variable "count". The initial value of the count is 5, and the maximum size of the buffer is 10. ***1 point***

Producer process	**Consumer process**

`while (true)`
`{`
`/* produce an item in next produced */`
`while (count == BUFFER_SIZE);`
`/* do nothing */`
`buffer[in] = next_produced;`
`in = (in + 1) % BUFFER_SIZE;`
`count = count +1;`
` }`
	`while (true)`
	`{`
	`while (count == 0);`
	`/* do nothing */`
	`next_consumed = buffer[out];`
	`out = (out + 1) % BUFFER_SIZE;`
	`count = count - 1;`
	`/* consume the item in the next consumed */`
	` }`

The statement count = count + 1 is implemented as

SP0: register1 = count
SP1: register1 = register1 + 1

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SP2: count = register1

The statement count = count - 1 is implemented as
SC0: register2 = count
SC1: register2 = register2 - 1
SC2: count = register2

Assume that the CPU schedules the producer-consumer problem as follows: SP0, SC0, SP1, SC1, SP2, and SC2. What is the final value of the count?

○ (A) 6
● (B) 4
○ (C) 5
○ (D) 3
○ (E) 2

10) To solve the critical section problem, the general structure of a process Pi includes ***1 point***

○ (A) entry section
○ (B) exit section
○ (C) critical section
○ (D) remainder section
● (E) All of the above

You may submit any number of times before the due date. The final submission will be considered for grading.

Submit Answers