West Virginia University
INSTITUTE OF TECHNOLOGY

CS 355 –Fall 2023

Assignment 2, Total Mark 12

Deadline: Friday, November 10, (11:59 pm) in e-campus

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Question 1: During process creation, how parent process prevents any process from overloading the system? (Answer within maximum two sentences) (1 point).

The parent process typically enforces resource allocation limits and scheduling constraints to prevent child processes from overloading the system, ensuring fair resource usage and system stability. In addition, the parent process can use mechanisms like process priorities and quotas to control and limit the resource usage of its child processes, preventing system overload.

Question 2: How shared memory model is advantageous than a message passing model for Interprocess communication? (Answer within maximum sentence) (1 point).

The shared memory model is advantageous because it allows processes to directly access as well as exchange data in memory without the overhead of message copying and synchronization, resulting in faster and more efficient communication.

Question 3: Write one “can do” and “cannot do” for the processes who function based on shared memory. (Answer within one sentence maximum for each case) (1 point).

Processes that use shared memory can efficiently exchange large volumes of data without the need for message passing which can improve performance. However, processes relying on shared memory cannot communicate with processes on separate, physically distant systems since shared memory is typically limited to processes running on the same machine.

Question 4: Write two differences between two different size message passing process. (1 point)

Smaller message-passing processes can be more efficient for transmitting small amounts of data. Larger message-passing processes may require more complex message handling mechanisms which could introduce higher overhead comparatively, potentially impacting system performance and scalability.

Question 5: For hard-coding techniques, where identifiers must be explicitly stated, what type of communication (naming) is desirable? (1 point)

For hard-coding techniques, where identifiers must be explicitly stated, using meaningful and self-descriptive names for communication (naming) is desirable. This enhances code readability and understanding, making it easier to maintain and debug.

Question 6: Write three main steps for POSIX IPC system as an example of shared memory based IPC (Answer within maximum three sentences only). (1 point)

> **Shared Memory Creation:** Use shm_open to create or open a shared memory object, and ftruncate to set its size.
> **Memory Mapping:** Employ mmap to map the shared memory object into the address space of the processes involved in communication.
> **Communication:** Use the shared memory region for communication, allowing multiple processes to read and write data in the shared memory as needed.

Question 7: Which ports are used to implement standard service communicating between client and server? (Write ranges of port only, answer should be in one sentence). (1 point)

The range of ports commonly used for implementing standard services in client-server communication is 0 to 1023, known as well-known ports or privileged ports.

Question 8: A process named D on host K wants to establish third connection with the same server where previously establish two more connections for two more processes named B and C where port number was 1625 and 1631 respectively. The port number can be assigned to D either 1011, 1027 or 1687. Write the reasons in one sentence (Answer in two sentences, one for port number and one sentence for reason for selection of port number). (1 point)

The D process should be assigned port 1687. This is to signify the fact that it comes after process B and C in order.q

Question 9: Why communication using Sockets is considered low level communication? (Answer in one sentence) (1 point)

Communication using sockets is considered low-level because it provides a basic interface for network communication, requiring manual handling of details such as data serialization, connection management, and error handling, giving developers fine-grained control but necessitating more manual effort.

Question 10: Write two reasons when RPC can fail (two sentence maximum). Write the solution (Answer within one sentence) (1 point)

RPC can fail due to network issues, such as packet loss or connection problems, and also due to server-side errors or unavailability, resulting in communication breakdown; a solution involves implementing robust error-handling mechanisms and retry strategies to

address network issues and handling server errors gracefully, ensuring more reliable RPC communication.

Question 11: Suppose that processes P1, P2, and P3 all share mailbox A. Process P1 sends a message to A, while both P2 and P3 execute a receive () from A. Which process will receive the message sent by P1? (Answer within maximum three sentences) (1 point)

The actual recipient among P2 and P3 depends on the scheduling order of the processes. If P2 executes the receive() first, it will receive the message, and similarly, if P3 executes the receive() first, it will be the one to receive the message sent by P1.

Question 12: Using the program provided below, explain what the output will be at lines X and Y. (Answer within maximum two sentences.) (1 point)

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```
#include <sys/types.h>
#include <stdio.h>
#include <unistd.h>

#define SIZE 5

int nums[SIZE] = {0,1,2,3,4};

int main()
{
int i;
pid_t pid;

   pid = fork();

   if (pid == 0) {
      for (i = 0; i < SIZE; i++) {
         nums[i] *= -i;
         printf("CHILD: %d ",nums[i]); /* LINE X */
      }
   }
   else if (pid > 0) {
      wait(NULL);
      for (i = 0; i < SIZE; i++)
         printf("PARENT: %d ",nums[i]); /* LINE Y */
   }

   return 0;
}
```