Which of the following statements about processes is/are correct?

Which of the following statements about processes is/are correct?

- [ ] a. All running processes share their address space among each other
- [ ] b. A program is a running instance of a process
- [x] c. A process is a running instance of a program ✔
- [x] d. The operating system allocates and manages resources of processes ✔
- [x] e. Each process has its unique process ID ✔

The correct answers are: A process is a running instance of a program, The operating system allocates and manages resources of processes, Each process has its unique process ID

Which of the following are typical process states?

Which of the following are typical process states?

- [ ] a. Dead
- [x] b. Running ✔
- [x] c. Sleeping ✔
- [ ] d. Waking up
- [x] e. Zombie ✔
- [ ] f. Undead
- [x] g. Stopped ✔

The correct answers are: Running, Sleeping, Stopped, Zombie

Which of the following are typical methods to work with processes?

Which of the following are typical methods to work with processes?

- [x] a. exec() ✔
- [ ] b. perform()
- [x] c. fork() ✔
- [x] d. wait() ✔
- [ ] e. spoon()
- [ ] f. waiter()

The correct answers are: fork(), wait(), exec()

Which of the following statements about process IDs is/are correct?

Which of the following statements about process IDs is/are correct?

- [x] a. The command getpid() never returns an error ✔
- [ ] b. A child process can be created with mkchild()
- [ ] c. The command getchildid() returns the process ID of the child process
- [x] d. The command getpid() returns the process ID ✔
- [ ] e. The command getppid() returns the process ID of the child process

The correct answers are: The command getpid() never returns an error, The command getpid() returns the process ID

After the execution of pid_t ID = fork(), the variable ID...

After the execution of pid_t ID = fork(), the variable ID...

- [x] a. ... is >0 if the parent process is active ✔
- [x] b. ... is 0 if the child process is active ✔
- [x] c. ... contains the process ID of the child process if the parent process is active ✔
- [ ] d. ... is -1 if the fork() command has failed
- [ ] e. ... contains the process ID of the parent process

The correct answers are: ... is 0 if the child process is active, ... is -1 if the fork() command has failed, ... is >0 if the parent process is active, ... contains the process ID of the child process if the parent process is active

Which of the following statements about the wait() and waitpid() commands is/are correct?

Which of the following statements about the wait() and waitpid() commands is/are correct?

- [ ] a. On failure, wait() returns 0
- [x] b. The wait() system call suspends execution of the calling process until one of its children terminates ✔
- [ ] c. On success, wait() returns the process ID of the terminated parent process
- [x] d. If errno is set to 0, this indicates that wait() has returned "no error" ✖
- [x] e. The waitpid() system call enables to wait for a specific pid ✔

The correct answers are: The wait() system call suspends execution of the calling process until one of its children terminates, The waitpid() system call enables to wait for a specific pid

Which of the following statements about the exec family of functions is/are correct?

Which of the following statements about the exec family of functions is/are correct?

- [x] a. Fork() and exec*() are often used in sequence to get a new process (program) running as a child of a current process ✔
- [ ] b. Well-known examples of exec*() functions are execfork() and execwait()
- [x] c. The exec*() functions replace the current process image with a new process image ✔
- [x] d. If the exec*() functions return to the calling process image, an error has occurred ✔
- [ ] e. In case of successful execution, the exec*() functions return the PID of the child process

The correct answers are: The exec*() functions replace the current process image with a new process image, If the exec*() functions return to the calling process image, an error has occurred, Fork() and exec*() are often used in sequence to get a new process (program) running as a child of a current process

Which of the following statements about threads and processes is/are correct?

Which of the following statements about threads and processes is/are correct?

- [ ] a. In a multi-threaded system, the operating system is not aware of threads
- [x] b. Threads are also called "lightweight-processes" ✔
- [ ] c. Processes are also called "lightweight-threads"
- [x] d. Threads provide a way to improve application performance through parallelism ✔
- [x] e. Threads allow the concurrent execution of instructions ✔

The correct answers are: Threads are also called "lightweight-processes", Threads allow the concurrent execution of instructions, Threads provide a way to improve application performance through parallelism

Which of the following statements about threads and processes is/are correct?

Which of the following statements about threads and processes is/are correct?

- [x] a. Threads of the same process can share the same set of open files and child processes ✔
- [ ] b. In case a process terminates, all related threads become zombie threads
- [x] c. Threads of the same process share the same address space ✔
- [x] d. Threads of the same process share their execution state ✖
- [ ] e. Communication between threads of the same process is easier than communication between multiple processes

The correct answers are: Threads of the same process share the same address space, Threads of the same process can share the same set of open files and child processes, Communication between threads of the same process is easier than communication between multiple processes

Which of the following statements about threads and processes is/are correct?

Which of the following statements about threads and processes is/are correct?

- [ ] a. Threads increase security (global variables are shared between threads)
- [x] b. Processes contain more meta-information than threads ✔
- [x] c. Threads can be terminated faster than processes ✔
- [ ] d. Process switching is faster than thread switching
- [x] e. Threads enable concurrency within a process ✔
- [ ] f. Processes can be created (forked) faster than threads

The correct answers are: Processes contain more meta-information than threads, Threads can be terminated faster than processes, Threads enable concurrency within a process

Which of the following statements about threading models and thread level types is/are correct?

Which of the following statements about threading models and thread level types is/are correct?

- [ ] a. Threads can be distinguished into application level threads and network level threads
- [x] b. Threads can be distinguished into user level threads and kernel level threads ✔
- [ ] c. In the team model, threads are logically organized as a chain of workers
- [x] d. In the pipeline model, the access to the input buffer must be synchronized ✖
- [x] e. In the dispatcher/worker model, the dispatcher thread receives the tasks and distributes them to multiple worker threads ✔

The correct answers are: In the dispatcher/worker model, the dispatcher thread receives the tasks and distributes them to multiple worker threads, Threads can be distinguished into user level threads and kernel level threads

Which of the following statements about thread synchronization and concurrency control is/are correct?

Which of the following statements about thread synchronization and concurrency control is/are correct?

- [x] a. Thread synchronization must ensure secure information exchange between threads and/or cooperative processes ✔
- [ ] b. A famous technique for concurrency control is called CoCo
- [ ] c. Critical section refers to code that is responsible for most of the execution time
- [x] d. A famous technique for concurrency control is called Mutex ✔
- [x] e. Thread synchronization coordinates the access to shared data in a defined order ✔

The correct answers are: Thread synchronization coordinates the access to shared data in a defined order, Thread synchronization must ensure secure information exchange between threads and/or cooperative processes, A famous technique for concurrency control is called Mutex

Which of the following statements about the pthread API is/are correct?

Which of the following statements about the pthread API is/are correct?

- [ ] a. pthread defines a set of JAVA programming language types, functions and constants
- [x] b. Often used pthread functions include pthread_mutex_lock() and pthread_mutex_unlock() ✔
- [ ] c. Often used pthread functions include pthread_mutex_acquire() and pthread_mutex_release()
- [x] d. pthread defines a set of C programming language types, functions and constants ✔
- [ ] e. All pthread functions start with "pthread_"

The correct answers are: pthread defines a set of C programming language types, functions and constants, Often used pthread functions include pthread_mutex_lock() and pthread_mutex_unlock(), All pthread functions start with "pthread_"

Which of the following statements about IPC is/are correct?

Which of the following statements about IPC is/are correct?

- [x] a. IPC is important when processes need to share data ✔
- [x] b. IPC is short for inter-process communication ✔
- [x] c. IPC enables communication and synchronization of processes that use the same address space ✖
- [x] d. Well-known IPC approaches include semaphores and pipes ✔
- [x] e. IPC is short for inter-program coordination ✖

Which of the following statements about signals is/are correct?

Which of the following statements about signals is/are correct?

- a. The kill command can only be used to send signals to zombie processes ✗
- b. Signals are an example of SYNchronous IPC ✗
- c. The routines for handling signals are called pipes ✗
- d. The key combination <Ctrl + C> sends an interrupt signal and usually causes the process to terminate ✓
- e. Signals are an example of ASYNchronous IPC ✓
- f. The kill command can be used to send signals to running processes ✓

Which of the following statements about message queues is/are correct?

Which of the following statements about message queues is/are correct?

- a. Messages are always received by FIFO ✗
- b. Message queues provide structured communication ✓
- c. A process can push data into a message queue which can be fetched by other processes ✓
- d. Each message queue is recognizable by its distinct process ID (pid) ✗
- e. Message queues are limited to only one sender-receiver pair ✗

Which of the following statements about message queues is/are correct?

Which of the following statements about message queues is/are correct?

- a. The command msgget(...) is used to receive a message ✗
- b. On success, msgget(...) returns 0 ✗
- c. Permission flags of message queues are similar to file permissions ✓
- d. Message queue operations include create, send, receive, delete ✓
- e. The command msgget(...) is used to create a message queue ✓

Message queues: The command int msgsnd(int msgid, const void *msg, size_t msgsize, int flags); sends a message. Which of the following statements about this command is/are correct?

Message queues: The command int msgsnd(int msgid, const void *msg, size_t msgsize, int flags); sends a message. Which of the following statements about this command is/are correct?

- a. msgid (the first parameter) contains the message ID ✖
- b. The corresponding method to receive a message is int msgget(...) ✖
- c. On success, msgsnd(...) returns 0 ✔
- d. msgid (the first parameter) contains the result of msgget(...) ✔
- e. The corresponding method to receive a message is int msgrcv(...) ✔
- f. On success, msgsnd(...) returns the message ID ✖

Which of the following statements about message queues is/are correct?

Which of the following statements about message queues is/are correct?

- a. A received message remains in the message queue but the IPC_RECEIVED flag is set to 1 ✖
- b. The message queue (not only one message) can be removed with msgdel(...) and the IPC_DEL option ✖
- c. The message queue (not only one message) can be removed with msgctl(...) and the IPC_RMID option ✔
- d. The command to receive a message is msgrcv(...) ✔
- e. A received message will be removed from the message queue ✔

Which of the following statements about named pipes is/are correct?

Which of the following statements about named pipes is/are correct?

- a. The command to create a named pipe is mkfifo(...) ✔
- b. stdio operations support the sending and receiving of messages ✔
- c. Client/server applications are a typical scenario for the usage of named pipes ✔
- d. Named pipes allow the prioritization of messages ✖
- e. When a message is read from the pipe it is marked as "consumed" but remains in the pipe ✖
- f. Named pipes provide stream-based unstructured communication ✔

Which of the following statements for open/read/write/close IPC operations of named pipes is/are correct?

Which of the following statements for open/read/write/close IPC operations of named pipes is/are correct?

- a. If a pipe is NOT opened for writing, reading returns EOF (and does not block) ✔
- b. Named pipes offer very good low-level synchronization for multiple readers/writers ✖
- c. A process using named pipes for reading is blocked until a process for writing is opened ✔
- d. If a pipe is opened for writing by at least one process, reading blocks in case of a full pipe ✖
- e. If a pipe is opened for reading by at least one process, writing blocks in case of an empty pipe ✖

Which of the following property assignments is/are correct?

Which of the following property assignments is/are correct?

- a. Message queues: identified by filename ✗
- b. Named pipes: concurrency supported/managed by OS ✗
- c. Named pipes: unstructured data ✓
- d. Message queues: stream oriented ✗
- e. Named pipes: pure FIFO ✓

Which of the following statements about the command line input "ps x | less" is/are correct?

Which of the following statements about the command line input "ps x | less" is/are correct?

- a. The output from "ps x" is forwarded as input to "less" (left -> right) ✓
- b. The command "|" is called a "message queue" ✗
- c. The command "|" allows unidirectional communication between two related processes ✓
- d. The output from "less" is forwarded as input to "ps x" (right -> left) ✗
- e. The command "|" is called an "(unnamed) pipe" ✓

Which of the following are advantages of distributed systems?

Which of the following are advantages of distributed systems?

- a. Lower communication ✗
- b. Increased simplicity ✗
- c. Higher throughput ✓
- d. Higher availability ✓
- e. Higher security ✗

Which of the following are requirements of distributed systems?

Which of the following are requirements of distributed systems?

- a. Monolithicity ✗
- b. Scalability ✓
- c. Fault tolerance ✓
- d. Centralization ✗
- e. Transparency ✓
- f. Homogeneity ✗

Which of the following pairs of requirements of distributed systems and their description is/are correct?

Which of the following pairs of requirements of distributed systems and their description is/are correct?

- a. Concurrency: mechanisms for data synchronization ✓
- b. Transparency: use of heterogeneous hardware ✗
- c. Openness: users should not recognize that they are using a distributed system ✗
- d. Scalability: no location dependent services/algorithms ✓
- e. Flexibility: extensibility of components ✓

Correctly assign the types of distribution transparency to the provided descriptions.

Correctly assign the types of distribution transparency to the provided descriptions.

(A): Recovery of a sub-component has no influence on the overall system

(B): Hides that an object may be moved to another location while in use

(C): Moving an object to a new physical location does not change the way of accessing it

(D): Multiple users may access the same object at the same time without noticing

- a. A = Failure; B = Relocation; C = Migration, D = Concurrency ✓
- b. A = Concurrency; B = Relocation; C = Migration, D = Failure ✗
- c. A = Relocation; B = Failure; C = Concurrency, D = Migration ✗
- d. A = Concurrency; B = Migration; C = Relocation, D = Failure ✗
- e. A = Failure; B = Migration; C = Relocation, D = Concurrency ✗
- f. A = Migration; B = Failure; C = Concurrency, D = Relocation ✗

Which of the following statements about TCP and UDP is/are correct?

Which of the following statements about TCP and UDP is/are correct?

- a. TCP and UDP are examples of protocols ✔
- b. TCP is connection oriented and allows only 1:1 connections ✔
- c. TCP allows broadcasting ✖
- d. TCP and UDP are examples of sockets ✖
- e. UDP uses the three-way-handshake ✖

Which of the following statements about sockets and ports is/are correct?

Which of the following statements about sockets and ports is/are correct?

- a. Sockets are endpoints for sending and receiving data across a network ✔
- b. A socket enables the usage of the TCP/IP stack ✔
- c. A port is a combination of IP address (host address) and socket ✖
- d. A socket is a combination of IP address (host address) and port ✔
- e. Ports are 8-bit numbers; valid port numbers are 0-255 (2^8-1) ✖

Which of the following statements about connection related functions of sockets is/are correct?

Which of the following statements about connection related functions of sockets is/are correct?

- a. The command bind(socket, addr, addrlen) can be used to allow a client to establish a connection ✖
- b. The command socket(domain, type, protocol) can be used to setup a connection ✖
- c. The command listen(socket, backlog) can be used to assign an address ✖
- d. The command connect(socket, addr, addrlen) can be used to create a socket ✖
- e. The command accept(socket, addr, addrlen) can be used to accept a client connection ✔

Which of the following statements about communication related functions of sockets is/are correct?

Which of the following statements about communication related functions of sockets is/are correct?

- [x] a. The function int sendto(...) can be used to send to a datagram socket ✔
- [x] b. The function int send(...) can be used to send to a stream socket ✔
- [x] c. Stream sockets usually use TCP, datagram sockets usually use UDP ✔
- [x] d. The function int recv(...) can be used to receive from a datagram socket ✖
- [x] e. The function int recvfrom(...) can be used to receive from a stream socket ✖
- [x] f. Both send(...) and sendto(...) return the count of bytes sent or -1 in case of an error ✔

In the following screenshot, /* TODO */ should be replaced with code for....

In the following screenshot, /* TODO */ should be replaced with code for....

```
1  const char *string = "Hello!"
2  int len = strlen(string) + 1;
3  if (send(sd, string, len, 0) == -1)
4  {
5      /* TODO */
6  }
```

- [x] a. blocking ✖
- [x] b. receiving from a datagram socket ✖
- [x] c. receiving from a stream socket ✖
- [x] d. error handling ✔
- [x] e. (re-)sending to a datagram socket ✖

Which of the following statements about servers/connections in a client/server architecture is/are correct?

Which of the following statements about servers/connections in a client/server architecture is/are correct?

- a. Connections can be performant or non-performant ✗
- b. Connections can be stateful or stateless ✓
- c. Connections can be iterative or concurrent ✓
- d. Connections can be coherent or consistent ✗
- e. Connections can be static or dynamic ✗
- f. Connections can be connectionless or connection oriented ✓

Which of the following statements about servers/types of connections in a client/server architecture is/are correct?

Which of the following statements about servers/types of connections in a client/server architecture is/are correct?

- a. Connection-oriented servers are highly performant but not always reliable ✗
- b. Iterative servers are typical for complex UDP servers ✗
- c. Concurrent servers are typical for TCP servers with simultaneous connections ✓
- d. Connectionless servers are very reliable but suffer from high overhead ✗
- e. Stateful servers suffer from high implementation complexity ✓

What are the advantages of LDAP?

What are the advantages of LDAP?

- a. Single sign on ✔
- b. No administration needed ✖
- c. Proprietary protocol ✖
- d. Open standard (RFC) ✔
- e. Tailored for one single platform ✖
- f. Single point of administration ✔

Which of the following statements about the LDAP data model is/are correct?

Which of the following statements about the LDAP data model is/are correct?

- a. The distinguished name (DN) identifies an entry unambiguously ✔
- b. The LDAP schema uses different naming conventions for each different object class/attribute ✖
- c. The object class defines a set of attributes belonging to an entry ✔
- d. A new LDAP entry needs to contain all "MAY" attributes of all used object classes ✖
- e. The base distinguished name (base DN) is the root node of the directory ✔

Which of the following LDAP data model standard attributes is/are correctly assigned?

Which of the following LDAP data model standard attributes is/are correctly assigned?

- a. user: user ID ✖
- b. pwd: password ✖
- c. sn: surname ✔
- d. cn: common name ✔
- e. o: name of the organization ✔
- f. uid: user ID ✔

Which of the following are possible operations of the LDAP protocol?

Which of the following are possible operations of the LDAP protocol?

- a. Binding ✔
- b. Add Entry ✔
- c. Compare Entries ✔
- d. Remove Entry ✔
- e. Modify Entry ✔
- f. Replace Entries ✖
- g. Searching ✔

Which of the following statements about LDAP sync replication (Syncrepl) is/are correct?

Which of the following statements about LDAP sync replication (Syncrepl) is/are correct?

- a. Syncrepl can only construct a consumer replica from a provider-side backup at a certain synchronization status ✖
- b. Syncrepl needs to manually resynchronize the consumer replica up-to-date with the current provider content ✖
- c. Syncrepl only supports push-based synchronization ✖
- d. Syncrepl supports pull-based and push-based synchronization ✔
- e. Syncrepl only supports pull-based synchronization ✖
- f. Syncrepl tracks status of the replication content by maintaining and exchanging synchronization cookies ✔

MirrorMode...

MirrorMode...

- a. ...uses the second provider for writes if the first provider crashes ✔
- b. ...needs to be manually synced in order to catch up to any changes on the running provider ✖
- c. ...employs an external frontend to simultaneously direct all writes to all servers ✖
- d. ...sets up two providers to replicate from each other ✔
- e. ...employs an external frontend to direct all writes to only one of the two servers ✔

Which of the following statements about time measurement basics is/are correct?

Which of the following statements about time measurement basics is/are correct?

- a. Accuracy is the measure for frequency fluctuations of a clock ✖
- b. Drift is the frequency deviation of two clocks ✔
- c. Precision is the degree of time resolution ✔
- d. Offset is the time difference between two clocks ✔
- e. Stability is the deviation of a clock from a reference time ✖

This time-plot shows the values of clock p at time t "C_i(t)".

Labels: x-axis: reference time "t"; y-axis: value of the clock at time t "C(t)"

Which of the following statements is/are correct?

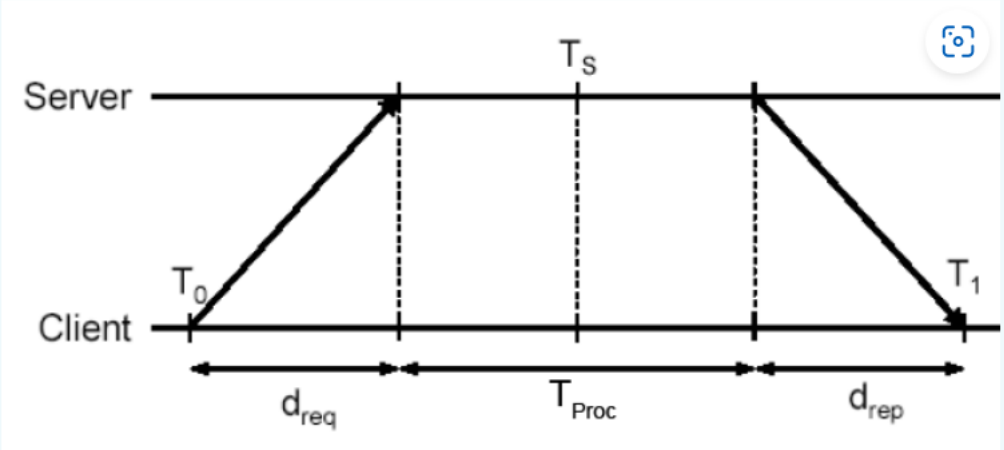
- a. C_1(t) and C_2(t) both have bad precision but good stability ✔
- b. C_1(t) has bad precision but good stability, C_2(t) has bad precision and bad stability ✖
- c. C_2(t) has bad precision but good stability, C_1(t) has bad precision and bad stability ✖
- d. C_3(t) has good stability but bad precision ✖
- e. C_3(t) has good precision but bad stability ✔

Which of the following statements about UNIX time is/are correct?

Which of the following statements about UNIX time is/are correct?

- a. The UNIX time counts seconds since January 1st 1970 ✔
- b. The UNIX time allows for calculating time until the year 2068 ✖
- c. The UNIX time counts seconds since January 1st 2000 ✖
- d. The UNIX time uses **signed** 32-bit values and is therefore limited to 2.147 billion seconds (~68 years) ✔
- e. The UNIX time allows for calculating time until the year 2038 ✔

The following figure shows Cristian's algorithm for clock synchronization.



Which of the following statements is/are correct?

- a. The server time T_S can be expressed as (T_1 – T_0)/2 ✔
- b. This figure assumes that the message propagation time for request is twice the message propagation time for reply ✖
- c. The server time T_S can be expressed as (T_1 T_0)/T_1 ✖
- d. The processing time T_Proc can be expressed as (T_1-T_0+d_req+d_rep) ✖
- e. This figure assumes that the message propagation times for request and reply are identical ✔
- f. The processing time T_Proc can be expressed as (T_1-T_0-d_req-d_rep) ✔

Which of the following statements about the Berkeley algorithm for clock synchronization is/are correct?

Which of the following statements about the Berkeley algorithm for clock synchronization is/are correct?

- a. One of its advantages is that it scales well with the number of clients ✗
- b. The Berkeley algorithm is a centralized approach ✓
- c. The Berkeley algorithm is a decentralized approach ✗
- d. Each client calculates its time difference to the average of all clients individually ✗
- e. The server polls the system time of all clients and calculates a time average ✓

Which of the following statements about the Network Time Protocol (NTP) is/are correct?

Which of the following statements about the Network Time Protocol (NTP) is/are correct?

- a. NTP has a precision of about 1 second in wide area networks ✗
- b. A stratum of 5 or higher means “unsynchronized” ✗
- c. Local clocks are adjusted in time and frequency by applying adaptive algorithms ✓
- d. Secondary servers and clients synchronize based on primary servers via a self-organizing, hierarchical network ✓
- e. NTP is limited to UNIX-like platforms (UNIX, Linux, MacOS, SunOS, ...) ✗
- f. NTP uses redundant servers and network paths to increase reliability ✓

Which of the following statements about clock synchronization based on logical clocks is/are correct?

Which of the following statements about clock synchronization based on logical clocks is/are correct?

- a. If a process sends a message to another process, then the "send" event may or may not happen before the "receive" event (égalité) ✗
- b. If a process sends a message to another process, then the "send" event has to happen before the "receive" event (causality) ✓
- c. Synchronization based on logical clocks is based on the correct order of events ✓
- d. It is not possible to make assumptions on the temporal order of **concurrent** events ✓
- e. Synchronization based on logical clocks requires a correct relation to the "real" time ✗

Which of the following statements about time measurement basics is/are correct?