Introduction to Computer Science-101
Homework 3_solution

1. What is the highest TCP/IP layer responsible for each of the following activities: (10%)
   a. Sending a frame to the next node.
   b. Sending a packet from the source to the destination.
   c. Delivery of a long message from the source computer to the destination computer.
   d. Logging in to a remote computer

   a. data link layer
   b. network layer
   c. transport layer
   d. application layer

2. What is the advantage of having three transport protocols in TCP/IP? (10%)
   An application can use whichever protocol is appropriate for that application. If an application needs to establish a reliable connection between machines, it can use TCP. If it only needs to send small amounts of noncritical information, it can use UDP to accomplish the transfer faster. SCTP combines the advantages of both UDP and TCP for real-time applications.

3. A user uses a browser to download a game program. What type of document is downloaded? (10%)
   What is downloaded is an active document because the game is needed to be run on the client site.

4. Change the following IP addresses from binary notation to dotted-decimal notation. (10%)
   a. 01111110 11110001 01100111 01111111   126.241.103.127
   b. 10111111 11011100 11100000 00000101   191.220.224.5

5. Why the virtual memory can seem bigger for the physical memory? Please illustrate the concept. (10%)
   This technique virtualizes a computer architecture's various forms of computer data storage (such as random-access memory and disk storage), allowing a program to be designed as though there is only one kind of memory, "virtual" memory, which behaves like directly and contiguous addressable read/write memory.

6. How is paging different from partitioning?(10%)
   In partitioning, memory is divided into variable-length sections, each of which holds one complete program. In paging, memory is divided into much smaller fixed-length sections as is the program itself; the program does not have to be contiguous in memory.

7. How does deadlock differ from starvation? (10%)
   Deadlock happens when processes are all waiting for resources held by other processes: they are all waiting for each other. This happens when the operating system does not put resource restrictions on processes. Starvation happens when

8. A monoprogramming operating system runs programs that on average need 10 microseconds access to the CPU and 70 microseconds access to the I/O devices. What percentage of time is the CPU idle? (10%)
   70 / (70 + 10) × 100 = 87.5%.

9. A multiprogramming operating system uses paging. The available memory is 60 MB divided into 15 frames, each of 4 MB. The first program needs 13 MB. The second program needs 12 MB. The third program needs 27 MB.(10%)
   a. How many frames are used by the first program?
   b. How many frames are used by the second program?
   c. How many frames are used by the third program?
   d. How many frames are unused?
   e. What is the total memory wasted (not considering memory lost inside each frame)?
   f. What percentage of memory wasted (not considering memory lost inside each frame)?

   a. 13 / 4 = 3.25 → 4 pages.
   b. 12 / 4 = 3 pages.
   c. 27 / 4 = 6.75 → 7 pages.
   d. 15 - (4 + 3 + 7) = 1 frame.
   e. Not considering memory lost inside each frame, one frame (4 MB) is unused.
   f. (4 / 60) × 100 = 6.66%.

10. Three processes (A, B, and C) are running concurrently. Process A has acquired File1. Process B has acquired File2, but needs File 1. Process C has acquired File3, but needs File2. Draw a diagram for these processes. Is this a deadlock situation? If your answer is "no", show how the processes can eventually finish their tasks. (10%)
    This is not a deadlock situation (see following Figure) because one of the necessary condition (circular waiting) is not present.