

1. "True" or "False"? If your answer is "False", please give your reason (if you do not provide any reason or your reason is incorrect, you can only obtain 2 points). And if your answer is wrong, you will obtain (-1) point.
 - a. (5%) To enlarge block size of the cache will always improve the memory accessing performance.
 - b. (5%) In the ideal pipeline system, all stages can operate simultaneously.
2. Please briefly explain
 - a. (5%) Concept of DLL (Dynamically Linked Libraries)
 - b. (5%) Hazards of pipeline architecture
 - c. (5%) Amdahl's law
 - d. (5%) Write through v.s. write back in cache memory
3. (5%) A pipeline system has 3 stages. The three stages take $S_1=3\text{ms}$, $S_2=2\text{ms}$, and $S_3=5\text{ms}$, to execute. What is the maximum throughput (instructions/second) of this pipeline system?
4. A benchmark program runs on a 2GHz machine with execution time of 800 seconds and $\text{CPI}=1.6$.
 - a. (5%) Please calculate its MIPS (millions instruction per second)
 - b. (10%) please determine the minimum required clock rate if we can reduce the execution time by 10%, however, the CPI becomes 1.8 while the number of instructions is unchanged.
5. Please explain the following terminologies and describe the functions they provide.
 - a. (5%) Content distribution networks (CDN).
 - b. (5%) Address resolution protocol (ARP).
6. The TCP congestion control mechanism operates at the sender by adjusting the size of the congestion window cwnd .
 - a. (10%) There are three major states of TCP congestion control: slow start, congestion avoidance, and fast recovery. Please describe the usage of each state, and how the size of cwnd changes when receiving a new ACK in each state.
 - b. (10%) Consider a TCP connection uses one R Mbps link. Assume the sender has a huge file to send and the receive buffer is larger than the congestion window. We also know that each TCP segment size is MSS bytes; the two-way delay of this connection is RTT msec; and finally the TCP connection is always in congestion avoidance phase. Please present the achievable maximum congestion window size (in segments) with R , MSS , and RTT .
7. IEEE 802.11 is one of the most popular wireless access technologies. Please answer the following questions.
 - a. What is the name of the random access protocol used in IEEE 802.11 networks (5%)? When there is an erroneous transmission detected, what will be the next operations at the transmitter side (5%)?
 - b. What is the hidden terminal problem in IEEE 802.11 networks (5%)? How to deal with it (5%)?

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