1. What is the difference of overflow and underflow? (10%)  

2. Please describe the steps in Unix systems while the operation system reads an executable file on disk to memory and starts it. (10%)  

3. The division of an instruction into five stages means a five-stage pipeline, which in turn means that up to five instructions will be in execution during any single clock cycle. Thus we separate the datapath into five pieces, with each piece named corresponding to a stage of instruction execution. Please describe the five stages briefly. (10%)  

4. The representation of a MIPS floating-point number is shown as \((s, exponent, significand)\), where \(s\) is the sign of the floating-point number (1 means negative), \(exponent\) is the value of the 8-bit exponent field (including the sign of the exponent), and \(significand\) is the 23-bit number in the fraction. What decimal number is represented by this word? (10%)  

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+11000001000000000000000000000000
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5. Suppose we have a processor which executes with a 500-MHz clock and hard disk with transfer speed of 4MB/sec. Assume that the initial setup of a DMA transfer takes 1000 clock cycles for the processor, and assume the handling of the interrupt at DMA completion requires 500 clock cycles for the processor. The hard disk has a transfer rate of 4MB/sec and uses DMA. If the average transfer from the disk is 8KB, what fraction of the 500-MHz processor is consumed if the disk is actively transferring 100% of the time? Ignore any impact from bus contention between the processor and DMA controller. (10%)  

6. Given a prefix as +A*-BC$DE, please find its related binary tree, infix and postfix by using traversal. (15%)  

7. Use Huffman algorithm to encode the following message such that it contains the minimum number of bits and the shortest code length. The message is AABCDBCAAABCCFEDEFAC. (15%)  

8. Please construct a minimum cost spanning tree for the undirected connected graph with the cost beside each link as shown below by (20%)  

(a) Kruskal’s algorithm without any constrain. (10%)  
(b) Prim’s algorithm without any constrain. (10%)  

(Note that mark the sequence number beside each link.)