Study Questions and Answers

ISA level

1. Consider the instruction LOAD M(X), which transfers the contents of memeory location X to the accumulator. Recall that instructions on this machine are 20 bits long: 8 bits for the opcode, and 12 bits for the operand. The opcode for the LOAD M(X) instruction consists of the 8 bits: 00000001.

   What would the machine code instruction look like to load the contents of memory address 2?

Load Op-code	**Operand**
00000001	000000000010

2. Bellekte bir komutun kendisi 300. adresi ise 301. adrese konmuştur. Adres sahasının değeri 200 dür. Verilen adres modları için efektif adresi hesaplayınız. ([R1] = 400) (15)
   a. direct
   b. immediate
   c. relative
   d. register indirect
   e. index (R1 index kayıtçı).

3. Bir bilgisayarın belleği 32 bitlik 256K kelimeden oluşmaktadır. Komutlar bir bellek kelimesinde kodlanmıştır. Komut: işlem kodu, kayıtçı (64 kayıtçıdan birisini belirtecek şekilde) kodu ve adres kısmından oluşmaktadır (10)
   a) Belleği data ve adres girişleri kaç bittir?
   b) Komut formatını çizerek her saha için gerekli bit sayısını belirtiniz.

4. The performance ratio of the IBM 360 Model 75 is fifty times that of the 360 Model 30, yet the instruction cycle time is only five times as fast. How do you account for this discrepancy?

   Other system components aside from clock speed make a big difference in overall system speed. In particular, memory systems and advances in I/O processing contribute the performance ratio. A system is only as fast as its slowest link. In recent years, the bottlenecks have been the performance of memory modules and bus speed.
5. While browsing at Billy Bob's computer store, you overhear a customer asking Billy Bob what is the fastest computer n the store that he can buy. Billy Bob replies, "You re looking at our Macintoshes. The fastest Mac we have runs at a clock speed of 1.2 GH. If you really want the fastest machine, you should buy our

2.4 GH Intel Pentium IV instead." Is Billy Bob correct? What would you say to help this customer?

Different systems are not comparable on clock speed. Other factors such as the system components (memory, buses, architecture) and the instruction sets must also be considered. A more accurate measure would be to run both systems on a benchmark. Benchmark programs exist for certain tasks, such as running office applications, performing floating point operations, graphics operations, and so on. The systems can be compared to each other on how long they take to complete these tasks.

6. Compare zero, one, two, and three address machines by writing programs to compute X=(A+B*C)/(D-E*F) for each of the four machines. The instructions available for use are as follows:

Zero address	One address
PUSH M	LOAD M
POP M	STORE M
ADD	ADD M
SUB	SUB M
MUL	MUL M
DIV	DIV M

Two address	Three Address
MOVE (X←Y)	MOVE (X←Y)
ADD (X←X+Y)	ADD (T← X + Y)
SUB (X← X-Y)	SUB (T ← X – Y)
MUL (X← X*Y)	MUL (T ← X * Y)
DIV (X ← X / Y)	DIV (T ← X / Y)

Here are some possible solutions, there are others.
Using zero address:

PUSH E	
PUSH F	
MUL	Stack contains E*F
PUSH D	
SUB	Stack contains (D-B*C)
PUSH B	
PUSH C	
MUL	Stack contains B*C , (D-E*F)
PUSH A	
ADD	Stack contains (A+B*C), (D-E*F)
DIV	
POP X	X contains (A+B*C)/(D-E*F)

Using one address:

```
LOAD F
MUL E           ; Acc = F*E
STORE X         ;  X = F*E
LOAD D
SUB X           ; Acc = D – F*E
STORE X         ; X = D-F*E
LOAD C
MUL B           ; Acc = B*C
ADD A           ; Acc = A+B*C
DIV X           ; Acc = (A+B*C)/(D-E*F)
STORE X         ; X = (A+B*C)/(D-E*F)
```

Using two addresses:

```
MUL E, F        ; E = E*F
SUB D, E        ; D = D-E*F
MUL B,C         ; B = B*C
ADD A,B         ; A = A+B*C
DIV A,D         ; A = (A+B*C) / (D-E*F)
MOVE  X,A       ; Copy A to X
```

Using three addresses:

```
MUL E, E, F     ; E = E*F
SUB  E, D, E    ; E = D-E*F
MUL X, B, C     ; X = B*C
ADD X, A, X     ; X = A+B*C
DIV X, X, E     ; X = (A+B*C)/(D-E*F)
```

Note that the previous two techniques destroy the contents of the original variables.

7.