Problem-1 (12 Points)
Write a program in 68020 assembly language to multiply a bit-field by another bit-field and store the result in memory as a third bit-field. The parameters of the bit-fields are as follows:

1st Bit-Field : EA=$2000, Offset=21, and Width=9
2nd Bit-Field : EA=$3000, Offset=12, and Width=12
3rd Bit-Field : EA=$4000, Offset=10, and Width=21

Problem-2 (14 Points)
Assume that the on-chip cache of a 68020 processor is empty. Based on the information given below, determine the total number of bus cycles necessary for fetching and executing the following program on the above mentioned 68020 processor.

```
MOVE.W #4,D3
MOVE.L #1,D0
OUTLOOP
    MOVE.W #9,D2
    INLOOP
        ADD.L D0,(A0)+
        DBRA D2,INLOOP
        ADDQ.L #1,D0
        DBRA D3,OUTLOOP
```

Information
- The cache is in enabled mode.
- The program starts from memory location $4000.
- Initial contents of A0 is $6002.
- The length of the ADD instruction is 2 bytes.
- The length of the ADDQ instruction is 2 bytes.
- The length of each DBRA instruction is 4 bytes.
- All the RAMs and ROMs of the processor have 32-bit ports.

Attention !!
You must show your work in detail; otherwise, no partial credits will be given if your results are not correct.

Problem-3 (20 Points)
Assume that the initial contents of some 8086 registers are:


Determine the physical address of the destination operand of each of the following instructions.

a) MOV [3000H].AX
b) MOV [BP+ SI + 10H].AX
c) MOV [DI + 10H].AX
d) MOV CS:[SI+5].AX
e) MOVSW

Problem-4 (18 Points)
Assume that the state of 8086's registers and memory is as follows:

- (AX) = 0105H   (DS:600)=15H   (DS:800)=20H
- (BX) = 0625H   (DS:601)=10H   (DS:801)=15H
- (CX) = 0205H   (DS:602)=29H   (DS:802)=45H
- (DX) = 0180H   (DS:603)=86H   (DS:803)=10H
- (SI) = 0800H   (DS:604)=60H   (DS:804)=40H

just prior to execution of each of the following instructions (independent instructions).

Show the result produced in the destination operand by executing instructions (a) through (d).

a) ADD AX, [0603H]
b) NEG WORD PTR [SI+1]
c) SHL BX,CL
d) MUL BL

Problem-5 (12 Points)
Two shared 16-bit numbers are located at physical addresses 23400H and 42500H respectively. Write a program in 8086 assembly language to swap the above mentioned two numbers. The subroutine must preserve all the registers of the 8086 processor. (Note: Shared numbers are to be modified in mutual exclusion)

Problem-6 (10 Points)
Write a subroutine to transfer data from a memory buffer to a 16-bit I/O port (located at address $0440H of the I/O space). Assume that the memory buffer starts from physical address 25400H. Once the data transfer operation is started, the processor should continue the operation until either 2048 words are transferred or the last word which is transferred is FF00H. The subroutine must preserve all the registers of the 8086 processor.

Problem-7 (14 Points)
Each of the following instructions has one or more syntax errors. Identify the error(s).

a) MOV 1234H.CS:[DI]
b) MOV AX,[BX + DI + 12A65H]
c) MOV AX,[DX + SI + 6]
d) MOV [BX].[DI + 12]
e) MUL [BX]
f) IN AL, BX
g) MOV DS,ES

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