

Problem 1

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1. bool need_valC = icode in {IIRMOVL, IRMMOVL, IMRMOVL, IJXX,
ICALL};
2. int aluB = [
    icode in {IRMMOVL, IMRMOVL, IOPL, ICALL, IPUSHL, IRET,
IPOPL} : rA;
    icode in {IRRMOVL, IIRMOVL} : 0;
];
3. bool mem_write = icode in {IRMMOVL, IPUSHL, ICALL};
4. int stat = [
    imem_error || dmem_error : SADR;
    !instr_valid : SINS;
    icode == IHALT : SHLT;
    1 : SAOK;
];

```

Problem 2

Stage	Generic	Specific
	mrmovl D(rB), rA	mrmovl 8(%ebp), %ecx
Fetch	icode:ifun ← M1[PC] rA:rB ← M1[PC+1] valC ← M4[PC+2] valP ← PC+6	icode:ifun ← M1[0x004]=5:0 rA:rB ← M1[0x005]=1:5 valC ← M1[0x006]=0x8 valP ← 0x004+6=0x00a
Decode	valB ← R[rB]	valB ← R[%ebp]=0x1000
Execute	valE ← valB+valC	valE ← 0x1000+0x8=0x1008
Memory	valM ← M4[valE]	valM ← M4[0x1008]=0x400
Write Back	R[rA] ← valM	R[%ecx] ← valM=0x400
Update PC	PC ← valP	PC ← valP=0x00a

Problem 3

Stage	Generic	Specific
	OPl rA, rB	andl %edx, %edx
Fetch	icode:ifun ← M1[PC] rA:rB ← M1[PC+1] valP ← PC+2	icode:ifun ← M1[0x03c]=6:2 rA:rB ← M1[0x03d]=2:2 valP ← 0x03c+2=0x03e
Decode	valA ← R[rA]	valA ← R[%edx]=0

	$\text{valB} \leftarrow R[rB]$	$\text{valB} \leftarrow R[\%edx] = 0$
Execute	$\text{valE} \leftarrow \text{valB} \text{ OP } \text{valA}$ Set CC	$\text{valE} \leftarrow 0 \& 0 = 0$ $ZF \leftarrow 1, SF \leftarrow 0, OF \leftarrow 0$
Memory		
Write Back	$R[rB] \leftarrow \text{valE}$	$R[\%edx] \leftarrow \text{valE} = 0$
Update PC	$PC \leftarrow \text{valP}$	$PC \leftarrow \text{valP} = 0x03e$

Problem 4

Stage	Generic	Specific
	$\text{popl } rA$	$\text{popl } \%ebp$
Fetch	$\text{icode} : \text{ifun} \leftarrow M1[PC]$ $rA : rB \leftarrow M1[PC+1]$ $\text{valP} \leftarrow PC+2$	$\text{icode} : \text{ifun} \leftarrow M1[0x045] = b:0$ $rA : rB \leftarrow M1[0x046] = 5:f$ $\text{valP} \leftarrow 0x045+2 = 0x047$
Decode	$\text{valA} \leftarrow R[\%esp]$ $\text{valB} \leftarrow R[\%esp]$	$\text{valA} \leftarrow R[\%esp] = 0x1000$ $\text{valB} \leftarrow R[\%esp] = 0x1000$
Execute	$\text{valE} \leftarrow \text{valB} + 4$	$\text{valE} \leftarrow 0x1000+4 = 0x1004$
Memory	$\text{valM} \leftarrow M4[\text{valA}]$	$\text{valM} \leftarrow M4[0x1000] = 0x1030$
Write Back	$R[\%esp] \leftarrow \text{valE}$ $R[rA] \leftarrow \text{valM}$	$R[\%esp] \leftarrow \text{valE} = 0x1004$ $R[\%ebp] \leftarrow \text{valM} = 0x1030$
Update PC	$PC \leftarrow \text{valP}$	$PC \leftarrow \text{valP} = 0x047$