1A)

Sequence with NOPs inserted:

ADD R5,R2,R1

NOP

NOP

LW R3,4(R5)

LW R2,0(R2)

NOP

OR R3,R5,R3

NOP

NOP

SW R3,0(R5)

1B)

Rearranged sequence with NOPs inserted as needed:

ADD R5,R2,R1

LW R2,0(R2)

NOP

LW R3,4(R5)

NOP

NOP

OR R3,R5,R3

NOP

NOP

SW R3,0(R5)

1C)

Instruction		Signals	
	PCWrite	**ForwardA**	**ForwardB**
ADD R5,R2,R1	**1**	**X**	**X**
LW R2,0(R2)	**1**	**X**	**X**
LW R3,4(R5)	**1**	**0**	**0**
OR R3,R5,R3	**1**	**10**	**0**
SW R3,0(R5)	**1**	**0**	**0**

1D)

The additional inputs to the hazard detection unit are register Rd from the ID/EX pipeline register and the output number of the output register from the EX/MEM pipeline register. The Rt field from the ID/EX register is already an input of the hazard detection unit. No additional outputs are needed. We can stall the pipeline using the three output signals that we already have.

1E)

Instruction		Signals	
	PCWrite	**IF/IDWrite**	**ID/EXzero**
ADD R5,R2,R1	**1**	**1**	**0**
LW R2,0(R2)	**1**	**1**	**0**
LW R3,4(R5)	**1**	**1**	**0**
OR R3,R5,R3	**0**	**0**	**1**
SW R3,0(R5)	**0**	**0**	**1**