REVIEW

Performance is an important metrics in evaluating the computer design.

Performance is measured by CPU execution time

CPU Execution time=

$(NumberofInstructions) \times$

$(NumberofClockcyclesperInstruction) \times$

$(ClockCycletime)$

Example: A program with 1000 Instructions, each has 2.5 CPI using 500 MHz CPU.

$Time = 1000 \times 2.5 \times 2ns = 5us$

Performance Improvement of computer A compared to B= $(performanceA) \div (performanceB) =$ $(ExecutiontimeB) \div (ExecutiontimeA)$

Must use benchmarks (SPEC) to evealuate performance

Use UNIX Command time to measure CPU time

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REVIEW: Instructions

- Arithmetic and Logic operations
  Example: convert C program to MIPS instructions
  $f = (g+h)-(i+j)$; assume f,g,h,i,j in R0,R1,R2,R3 and R4.
  ADD R0, R1, R2 ; $f = g + h$
  ADD R1, R3, R4 ; $h = i + j$
  SUB R0, R0, R1 ; $f = (g + h) - (i + j)$

- Data Transfer:
  Example: $g = h+A[i]$, if g,h,i are at R1,R2,R4 and base of A[0] is assigned to R3.
  multi R4, R4, #4 ; R4=4i
  ADD R3, R3, R4; R3=address of A[i]
  LW R4, 0(R3) ; R4=A[i]
  ADD R1, R2, R4; g=h+A[i]

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REVIEW: Instructions

- Instructions for Making Decisions:

  beq reg1, reg2, L1; if(reg1==reg2) goto L1

  bne reg1, reg2, L1; if(reg1!=reg2) goto L1

  Example: if(i==j) goto L1;
  g=g+h;
  L1: f=f-i;
  assume f,g,h,i and j at R0,R1,R2,R3,R4

  The instructions for the above example:
  beq R3, R4, L1; if (i==j) goto L1
  ADD R1, R1, R2 ; g=g+h
  L1: SUB R0, R0, R3; f=f-i

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Examle: while(save[i]==k)
i=i+j;
assume i,j,k assigned to R3, R4, R5, and base of save[0] at R6

L1 : multi R1, R3, #4 ; i=4i
ADD R1, R6, R1 ; R1= address of save[i]
LW R7, 0(R1) ; R7=save[i]
bne R7, R5, Exit;
ADD R3, R3, R4 ; i=i+j
j L1;
Exit: ;

Instructions for Less Than:
slt R1, R2, R3 ; if (R2 < R3) R1=1; else R1=0;

Instructions for Switch Statement:
jr R1 ; Jump based on R1 value (goto address =R1)

Supporting Procedures:
jal procedure address; save return address (PC+4) in R31, then jump to procedure address
At the end of procedure use jr R31
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