(S60005: High Porformance Computer Architecture [Spring 2024] Speedup= Model Solution (Class- Jost - 3) CPI work : CPI base + Shells would be CPI base + States or B Stolls/wests: (150/2) * 2 = 0.15 = 2: 0:30 por of cycles/instruction fraction of bronch instructions for Shellsers, Consider the following Penalty (deycles) BTB BTB vesult prediction (per instr.) Miss Miss NIA 15% * 10% = 0.015 150/0 *90% *90% = 0.1215 Hit Correct W Hit 15-0/0 + 90% * 10% = 0.0135 Incorrect : States /BIB: (0.015+1) + (0.1215+0) + (0.0135+3) = 0.06+0+0.0405 = 0.1005 Ger Processor-2 Speedup = 10+030 = 13 = 118 b) (Processor-3) Has MO BIB, No branch prediction. Since Branch Outcome is resolved in Ex stage, there is a 2 d cycle yhou, penalty if branch is taken. Suppose the % of taken branches is x%. Then, Shapped processor-3 = Question thereing 0.15 * (1 - \frac{1}{100}) * 0 + 0.15 * \frac{14 * 02}{100} \tag{Pen} branch instructions penaltyfor every talrew branch -= 0.003 % 1.0+ anogsacr 0.30 CPI/processor-1 1.0+0.0032 : Speedup = 160% taken 1.0+(0.003+60) = Suppose n = 60%

2 Note: there can be weltiple correct instruction sequences that for verilt in (d) Size of 8HT = (A of enteres) x (longth of early entry) = 26 + 14 bit) Size of BPB = (Hof entire) + (Size of each entry) = 2 Mx 3 his Shall because of COB contentions. total size = (26x14+24+3) bib = 500486ib = 6256 bytes Instr fadd.d add x1, x1, x2 Note: assuming half & cycle read of register during ID Stage Mile, un forwarding 5=) Stell, 18 19 20 21 22 23 24 10 11 12 15 14 15 14 17 as Instr. Koop: Pd X1,0(X2) addi XI, XI, 1 Sd X1, 0(X2) add: x2, x2,4 Bub X4, X3, X2 Barranalman (incorrect Successor-1) (6) The unvolved loop could have started the "ld" instruction of the next iteration on the house shought to the forest However, because of the branch overhead, it can start on three 2,186 & : Hof of cycles branch overhead = 42 Cycle. (e) If there is a "Koop Predictor" colicle identifies a backworld branch in the ID stage (cycle # 2019) there would only be a single amote Strade (systather), I the west iteration constant from cycle # 20 . Hof degeles last due to branches: \$ 1