## 3: COMPUTER ARCHITECTURE VELMA DHATRI REDDY CS2323: COMPUTER ARCHITECTURE AIDIBTECHT1030

1. Maximum value among the delays = 145ps Clock cycle = (N5+121ps = 157ps 2901A 20)

(a) No. of instructions = 1000 noterni je on lator (d) Not of cycles = 1000+6-1 = 1005 on lotal

Total time to execute = 1005 x 157 ps swil (11)

27(0H2+10031) = 27031(1-2+157,785 ps

(b) Total no: of instructions = 1000 + 20 × 1000 (20) (20) of instructions incurs a 2 office stall)

No. of cycles = 1200+6-1= 1205

Total time to execute = 1205 x 157 ps. 19 13001t.
- 129,185 = 189,185 ps - 189,185 = 189,185 ps

(c) substituting the value of x 5000 in the above gT boug IT to avoitours

2.(a) Total latency of P1 = 800ps (which is equally divided) Clock period for processor pro- 800% = 160 ps Agral - again again - studies of moit-later ALU latency of Pa is increased by 250ps 080111201ALUA Lateury = 160 + 250 = 410ps. Clock period for perocesson P2 = 210 ps (as 410ps le the max time) = slope d'al) (b) Total no. of instructions to be executed by  $P_0 = x$ Total no. of instructions to be executed by  $P_0 = 9x$ (Ti) Time for  $P_1 = (x+5-1)160ps = (160x+640)ps$ (T2) Time for P2 = (92/10+5-1) 410P3 = (36920+1640) PS for any 2>0 To is always greater than T, => 209x + 1000 > 0 => 209x + 10000 > 0 Hence, P, executes a given code in smaller time.

(c) substituting the value of n = 5000 in the above equations of  $T_1$  and  $T_2$ 

Execution time on 1 P, 10= 160 (5000) + 640 in (d) Lordoni la apola DX3= 8,00,640, parcoral od No Execution time on Po = 369 (2000) + 1640 11 1918 118 bbo 31 11 11. IF ID EXE MEM WB add 715, 715 3) (a) 1. add 214, 212, 211 NOP, < 1 add 20, 20, 20 " 214 which is needed in instruction 1. 215, 214, 217 214 to 2NAPE 291 added 2. add Reason: (NOP2) (EIR) 8 (RIB) X13, 8(X13) 1213 needed in instruction 5 (ME)0 (SIR 19) M2, O(X14) is loaded in Tinstruction 3. NOP = add 2011 260 700 I NOP is added to make a 5. and 213, 215, 213 difference blus these instructions 26, 260, 260 NOP 5 add Keason: (b) ai fi so) NOP3 (add 20, 20, 20, 20) 2/13 heeded in instruction 213 needed in instruction 6 us calculated in instruction 2911/ H(2(3)) 5. To Two NOPs are 213, 0(215) 78. 5d addled to make a difference of a toget the correct value.

(b) 214 which is needed in instruction 2 in exe stage can be forwarded from exe stage of instructions Hence, no Nops needed of No smil- Noithbooks add 214, 212, 211 IF ID EXE MEMI WB MEM WB add 713, 714, 713

11 X 151 X 141 X 6000 1 (6) (6) IF EXE MEM WB 215 which is needed in instruction 5 lin exe stage I can be forwarded from mem stage of instruction to side thences, no hops needed.

belode needed of MR GIX IMR (20) 6000.8 1d 8(213) IF ID EXE MEM WB (EIX) 8, EIX a northwari Pri Exem MEM WBIO GIX 1d 212, 0(214) and 213, 215, x 3 ENGHOUSENIFNI DIDOOD EXE OMEM WB i mor us added to make a 5-and EIX, EIX I EIX 213 which is neededoin instruction 6 on MEM stage (as it is 1d) can be forwarded from MEM stage of Instruction 5. Hence, no Nors, needed. a noitement of the memic wis or or month wearing to Franchexe MEMIN WIB 780 50 (air) 0(715) 50 (B) mettence, the code sumains the same as 10 no NOPs are to be inserted.