Løsningsforslag til oppgaver i digitalteknikk uke 10 (5/3 til 9/3)

Oppgave 8.
Jumps in the code may result in pipeline operations being wasted.

Oppgave 9.
A typical example of a data dependency problem is when an instruction uses the results of the previous instruction but the piplining means that the result does not get written to the register until after the first instruction reads the register that is supposed to hold the result. The use of operand forwarding will reduce this problem by including a data path that will feed the output from the ALU directly to one of the ALU's temporary input registers. Hardware interlocking and scoreboarding may also be considered. The above example considers register write-back delay, but you can also consider the memory load/store problem.

Oppgave 10.
Conditional branches cause any other instructions in the pipeline to be flushed as they are no longer required. A compiler can identify the existence of a conditional branch and thus can insert nop instructions forming a delayed branch so that the pipeline does not need to be flushed.

Oppgave 11.
(i) n x Pb cycles
(ii) 1 – (n x Pb) cycles
(iii) n x Pb x Pt cycles
(iv) n x Pb x (1 – Pt) cycles
(v) let Px = Probability of branch instruction being taken; Px = Pb x Pt
Number of cycles = (n x Px x (1 + b)cycles) + (n x (1 – Px) x 1cycle)
= nPx + bPx + n – nPx cycles
= n + bPx or n + (n x Pb x Pt x b) cycles
(vi) (n + (n x Pb x Pt x b)) / n = 1 + (Pb x Pt x b)