Processor Architecture

What is a *branch delay slot* and why does it arise? [7 marks]

How can branch delays be avoided? [7 marks]

If a processor exhibited one branch delay slot how would you reorder (and possibly modify) the instructions in the following loop to gain a performance advantage?

```
loop
  ldr r2, r3, #4  % r2=load(r3), r3=r3+4
  add r4, r4, r2  % r4=r4+r2
  add r1, r1, #1  % r1=r1+1
  cmp r1, #10     % compare r1 with constant 10
  bne loop       % branch if not equal to loop
```

[6 marks]