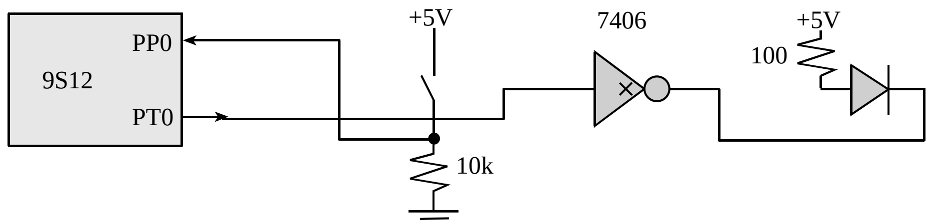
(4) Question 1. The basis elements are 1000=27, 0100=9, 0010=3, and 0001=1* 27+2*9+0*3+1=46
(3) Question 2. Answer true/false for each of the following three statements
Part a) False, Flash EEPROM memory on the 9S12 is nonvolatile.
Part b) True, the order in which I add the numbers does affect the final value of the carry bit.
Part c) True, dropout error can occur on a logical right shift (e.g., `lsra`). Overflow can occur.
(4) Question 3. Consider `ldab #-100    subb #50`
Convert to signed (done), Subtract two signed -100 - 50 is -150. Does not fit, so V=1.
Convert to unsigned -100 = -100+256 = 156. Subtract unsigned 156-50 is -106. This fits, so C=0.
(4) Question 4. What is the binary representation of 8-bit signed number -10?
Method 1) +10 is 8+2 or 00001010. Negative is 2's complement. Complement 1111,0101, then add 1. **11110110**
Method 2) Look at basis elements, need -128,64,32,16,4,2, so **11110110**
Method 3) -11 is the same binary as -10+256 = 246. 246/16=15 remainder 6. So hex is $F6
(20) Question 5. The current through LED resistor 25mA = (5-2-0.5)/R. Solve for R= 2.5V/25mA = 100Ω. The pull down resistor on the switch could be 10kΩ or 100kΩ. I will even count 1kΩ or 1MΩ.



(5) Question 6. The bus cycles occurring for `stx $2000`

R/W	Addr	Data	Changes to D,X,Y,S,PC,IR,EAR
R	$5200	$7E	PC=$5201,IR=$7E
R	$5201	$20	PC=$5202
R	$5202	$00	PC=$5203,EAR=$2000
W	$2000	$12	
W	$2001	$34	

(20) Question 7. Mask the bits of interest, then compare.

```
; fastest execution
Check ldaa PTT  ;read all 8 bits
      anda #$45 ;look at just bits 6,2,0
      cmpa #$01 ;expected value
      bne  done
      bset PTT,#$80 ;PT0=1, PT2=0, and PT6=0 so make PT7=1
done  rts
```

```
;simple to understand
Check ldaa PTT  ;read all 8 bits
      bita #$44 ;look at bits 6,2
      bne  done ;skip if either PT6 or PT2 are 1
      bita #$01 ;look at bit 0
      beq  done ;skip if PT0 is 0
      oraa #$80 ;PT0=1, PT2=0, and PT6=0 so make PT7=1
      staa PTT
done  rts
```

```
;fewest number of instructions
Check brset PTT,#$44,done ;skip if either PT6 or PT2 are 1
      brclr PTT,#$01,done ;skip if PT0 is 0
      bset  PTT,#$80 ;PT0=1, PT2=0, and PT6=0 so make PT7=1
done  rts
```

(20) Question 8. Write an assembly language subroutine that adds two unsigned 16-bit numbers.

```
;simple to understand
      org  $2000 ;RAM
yval  rmb  2
      org  $4000
add   sty  yval   ;save in variable
      tfr  x,d
      addd yval   ;add two inputs
      bcc  ok
      ldd  #65535 ;ceiling on overflow
ok    rts
```

```
;uses stack, so no global is required
add   pshy        ;save Y on stack
      tfr  x,d
      addd 2,sp+  ;add two inputs
      bcc  ok
      ldd  #65535 ;ceiling on overflow
ok    rts
```

---

(20) Question 9. A subroutine that counts the number of binary bits that are zero.

```
;simple to understand
Count clrb      ;result
      ldx  #8   ;loop counter
loop  lsra      ;bit into carry (could shift right or left)
      bcs  skip
      incb      ;found a zero
skip  dbne x,loop
      rts
```

```
;fastest to execute, does not require a loop counter
Count clrb      ;result
      coma      ;will be counting 1's now
loop  bpl  skip ;bit7=0, do not count
      incb      ;found a 1 (means found a 0)
      lsla      ;move bits into bit7
      bne  loop ;done when A=0
      rts
```