ELEC 464 : MICROCOMPUTER SYSTEM DESIGN
FALL 1995

Assignment 2
Solutions

Question 1 and 2

See reverse.

Question 3

- $t_{\mathrm{ELEH}} = t_{\mathrm{SL}}(\mathrm{w})$
  $= 115$ ns
  RAM requires 100ns so this requirement is met
- $t_{\mathrm{AVEL}} = t_{\mathrm{AVRL}} + t_{\mathrm{RLSL}}$
  $= 20 + 80 = 100$
  RAM requires 0ns so this requirement is met
- $t_{\mathrm{AVEH}} = t_{\mathrm{AVSL}} + t_{\mathrm{SL}}$
  $= 30 + 240 = 270$
  RAM requires 115ns so this requirement is met[1]
- $t_{\mathrm{AVAV}} = 4\, t_{\mathrm{cyc}}$
  $= 4 \times 125 = 500$ ns
  RAM requires 120ns so this requirement is met
- $t_{\mathrm{DVEH}} = t_{\mathrm{DOSL}} + t_{\mathrm{SL}}(\mathrm{w})$
  $= 30 + 115 = 145$ ns
  RAM requires 50ns so this requirement is met
- $t_{\mathrm{EHDX}} = t_{\mathrm{SHDOI}}$
  $= 30$ ns
  RAM requires 0ns so this requirement is met

Question 4

- $t_{\mathrm{W}} = t_{\mathrm{SL}}(\mathrm{w})$
  $= 115$
  DAC requires 50 ns so this requirement is met
- $t_{\mathrm{DS}} = t_{\mathrm{DOSL}} + t_{\mathrm{SL}}(\mathrm{w})$
  $= 30 + 115$
  DAC requires 70 ns so this requirement is met
- $t_{\mathrm{DH}} = t_{\mathrm{SHDOI}}$
  $= 30$
  DAC requires 30 ns so this requirement is met
- $t_{\mathrm{CS}} = t_{\mathrm{AVSL}} + t_{\mathrm{SL}}$
  $= 30 + 240 = 270$
  DAC requires 60 ns so this requirement is met
- $t_{\mathrm{CH}} = t_{\mathrm{SHAZ}}$
  $= 30$
  DAC requires 0 ns so this requirement is met

[1] An alternative solution is:
$t_{\mathrm{AVEH}} = t_{\mathrm{AVRL}} + t_{\mathrm{RLSL}} + t_{\mathrm{SL}}(\mathrm{w})$
$= 20 + 80 + 115 = 215$
RAM requires 115ns so this requirement is met
In a real design we would use the larger (270ns) value, (see p. 296) but either solution will be accepted.