Code :R7420406

IV B.Tech II Semester(R07) Regular Examinations, April 2011
DSP PROCESSORS & ARCHITECTURES
(Common to Electronics & Communication Engineering, Electronics & Instrumentation Engineering)

Time: 3 hours   **Max Marks: 80**

Answer any FIVE questions
All questions carry equal marks
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1. For the FIR filter
   $Y(n) = [x(n) + x(n-1) + x(n-2)]/3$
   Determine the:

   (a) System function

   (b) Magnitude response function

   (c) Phase response function

   (d) Impulse response

   (e) Step response

   (f) Poles and zeros.

2. (a) Compute the dynamic range and percentage resolution of a signal that uses.

      i. 16-point fixed-point format.
      ii. 32-point floating-point format with 24 bits for the mantissa and 8 bits for the exponent.

   (b) Write the brief notes on A/D conversion errors.

3. (a) Draw a structure of 8X8 Braun multiplier.

   (b) Draw the neat diagram of MAC with accumulator guard bit and explain in detail.

4. (a) Explain when a program can make all the four functional units in the CPU to do productive work in all the cycles.

   (b) Draw the table showing the content of the instruction pipeline when each of the following program is executed. Program is: LAR AR1#167h.
   LACC#164h
   SAMM AR2
   NOP
   LACC *+
   ADD *+
   SACL*+
   LAMM AR2.

5. (a) Explain The difference between the internal and external modes of clocking TMS 320C54XX processors how do you vary the clock frequency in each case?

   (b) Write a TMS 320C54XX program to mask the lower 6 bits of a word stored in the data memory and write the modified word back at the same location.

6. (a) Determine the value of each of the following 16-bit numbers represented using the given Q-notation:

      i. 4400h as a Q0 number
      ii. 4400h as a Q15 number
      iii. 4400h as a Q7 number
      iv. 3400h as a Q0 number.

   (b) Write a brief notes on interpolation filter with suitable example.

7. (a) Implement the 8-point DIFFFT butterfly.

   (b) Write a subroutine to compute the signal spectrum using result of 8-point FFT on TMS320c54XX.

8. (a) Explain clearly how does DMA help in increasing the processing speed of a DSP processor?

   (b) How does the interrupt handling in the TMS320c54XX DSP differ for a software and hardware interrupt.

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$$\boxed{2}$$

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1. For IIR filter
   $H(z) = \frac{(z-1)}{(z-.025)(z-0.5)}$
   Determine the:

   (a) magnitude response function

   (b) Phase response function

   (c) Impulse response

   (d) Step response

   (e) Poles and zeros

2. (a) Write a brief note on following:

   i. DSP computational errors

   ii. D/A conversion errors.

   (b) Show that the dynamic range of a signal increases by 6db for each additional bit used to represent its value.

3. (a) How will you implement an 8X8 multiplier using 4X4 multipliers as the building blocks?

   (b) What distinguishes a digital signal processor from a general-purpose micro-processor with regard to basic capabilities?

4. (a) Draw the table showing the content of the instruction pipeline when each of the following program is executed.
   Program is:
LDP	20h	
LACC	30h	
Sub	#30h	
BCND	YY,GT	
B	YY	
XX	NEG	
YY	SACL	30h

   (b) Explain when a program can make all the four functional units in the CPU to do productive work in all the cycles.

5. With suitable diagrams explain the internal and external modes of clocking TMS320C54XX processors. How do you vary the clock frequency in each case?

6. (a) Write a brief notes on decimation filters with suitable example?

   (b) Write short notes on adaptive filters.

7. (a) Draw the signal flow graph for an 8-point DFT computation and explain implementations.

   (b) Write a subroutine to compute the signal spectrum using the result of the 8-point FFT on TMS320C54XX.

8. (a) What are the various classifications of interrupts for the TMS320C5416 processor?

   (b) With neat diagram explain the CODEC interface circuit.

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1. (a) Given the sequences.

   $x_1(n) = \begin{bmatrix} 3 & 4.2 & 11 & 0 & 7 & -1 & 0.2 \end{bmatrix}$

   $x_2(n) = \begin{bmatrix} 1.2 & 3 & 0 & -0.52 \end{bmatrix}$

   Compute and plot the sequence $x_1(n) * x_2(n)$. Determine the length of the computed sequence.

   (b) Write the MAT LAB program for 11R filter.

2. (a) Compute the dynamic range and the percentage resolution for a block floating-point format with a 4 bit exponent used in a 16-bit fixed-point processor.

   (b) Write the brief note on:
       i. Compensating filters.
       ii. DSP computational errors.

3. (a) What distinguishes a digital signal processor from a general-purpose micro-processor with regard to basic capabilities?

   (b) Draw the structure of a 8X8 Braun multiplier.

4. (a) Explain how pipeline conflicts occurs when the program memory and data memory space of a program are contained in external memory space.

   (b) Draw the table showing the content of the instruction pipeline when each of the following program are executed.

   Program is:
LAR	ARI,#167h.
LACC	#164h
SAMM	AR2
LACC	*+
ADD	*+
SACL	*+
LAMM	AR2

5. Identify the addressing mode of the source operand in each of the following instructions:

   (a) ADD   *AR2,A

   (b) ADD   *AR2+,A

   (c) ADD   *AR2+%,A

   (d) ADD   #offh, A

   (e) ADD   1234h,A

   (f) ADD   *AR2+OB,A

   (g) ADD   *+AR2,A

   (h) ADD   +*AR2,A.

6. (a) Represent each of the following as 16-bit numbers in the desired Q-notation.
       i. 0.3125 as a Q15 number.
       ii. -0.3125 as a Q15 number.
       iii. 3.125 as a Q7 number.
       iv. -352 as a Q0 number.

   (b) Write notes on 2-D signal processing.

7. Derive the optimum scaling factor for the DIF FFT butterfly.

8. (a) Draw & explain the flow chart of interrupt handling by the TMS320C54XX.

   (b) With suitable timing diagrams explain I/O interface signals for read-write operation.

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$\boxed{4}$

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1. (a) Write MAT LAB programs for FIR filter.

   (b) Assuming X(k) as a complex sequence, determine the number of complex and real multiplies for computing IDFT using direct and radix-2 FFT algorithms.

2. (a) Show that the dynamic range of a signal increases by 6dB for each additional bit used to represent its value.

   (b) Compute the dynamic range and the percentage resolution for a block floating-point format with a 4-bit exponent used in a 16 bit fixed-point processor.

3. (a) How will you implement an 8X8 multiplier using 4X4 multipliers as the building blocks?

   (b) Explain about MAC unit, draw the diagram of MAC unit.

4. (a) Draw the table showing the content of the instruction pipeline when each of program is executed.
   Program is :   LAR AR1,   1200h
                     LAR AR2,   1300h
                     LAR AR3,   02h
                     MAR*,   AR1
              XX   LACC*+,   AR2
                     SACC*+,   AR3
                     BANZ XX,   AR1
                     ADD*-
                     ADD*-

   (b) Explain when a program can make all the four functional units in the CPU to do productive work in all the cycles.

5. (a) Write a sequence of TMS320C54XX instructions to configure a circulars buffer with a start address at 0200h and an end address at 021FH with current buffer pointer (AR6) pointing to address 0205h.

   (b) Write a TMS320C54XX program to compute the equation. Y=mx+C Assume that 'x' and 'C' are stored in the data memory and 'm' in the program memory. The result should be stored in the data memory.

6. (a) Determine the linearly interpolated sequence from the given sequence.
   $x(n) = \begin{bmatrix} 0 & 4 & 8 & 12 & 16 & 12 & 84 & 0 \end{bmatrix}$
   For an interpolation factor of 3 what interpolating sequence h(n) can achieve the specified interpolation?

   (b) Explain with an example how PID controller is implemented using TMS320C54XX.

7. (a) Write about scaling and overflow in FFT algorithms?

   (b) What minimum size FFT must be used to compute a DFT of 40 points? What must done to the samples before the chosen FFT is applied?

8. (a) What are the various classifications of interrupts for the TMS320C5416 processor?

   (b) Explain CODEC DSP interfacing with an example.

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