Question – 1: How are DSP processor is different from a normal microprocessor?

Answer: A general purpose microprocessor is a processor that is not tied to or integrated with a particular language or piece of software. Most general purpose microprocessors are present in personal computers. They are often used for computation, text editing, multimedia display, and communication over a network. Other microprocessors are part of embedded systems. These provide digital control over practically any technology, such as appliances, automobiles, cell phones, industrial process control, etc.

The DSP processor, on the other hand, is a particular type of microprocessor. DSP stands for digital signal processing. It is basically any signal processing that is done on a digital signal or information signal. A DSP processor is a specialized microprocessor that has an architecture optimized for the operational needs of digital signal processing.

The main difference between a DSP and a microprocessor is that a DSP processor has features designed to support high-performance, repetitive, numerically intensive tasks. DSP processors are designed specifically to perform large numbers of complex arithmetic calculations and as quickly as possible. They are often used in applications such as image processing, speech recognition and telecommunications. As compared to general microprocessors, DSP processors are more efficient at performing basic arithmetic operations, especially multiplication.

Most general-purpose microprocessors and operating systems can execute DSP algorithms successfully. However, they are not suitable for use in portable devices such as mobile phones. Hence, specialized digital signal processors are used. Digital Signal Processors have approximately the same level of integration and the same clock frequencies as general purpose microprocessors, but they tend to have better performance, lower latency, and no requirements for specialized cooling or large batteries. This allows them to be a lower-cost alternative to general-purpose microprocessors.

DSPs also tend to be two to three times as fast as general-purpose microprocessors. This is because of architectural differences. DSPs tend to have a different arithmetic Unit architecture; specialized units, such as multipliers, etc

In shorts dsps are comparitively faster,cheaper and are better optimised for specific operations.

Question – 2: List out various applications of DSP processor.

Answer: Various applications of DSP processor are-

- It is used in seismic data processing.
- It is used in statistical signal processing.
- It is used in voice recognition systems.
- It is used in digital images (HD).
- It is used as filter design for receiver applications.
- It is used in radar, sonar signal analysis and processing.
- All the processes done in mobile communication have DSP in them.
- It is used in biometric systems such as ECG, EEG, MRI and CT scan.
- It is used in video compression and speech compression.
- It is used in hi-fi loudspeakers crossovers and equalization.

Question – 3: Berifly and explain the evolution of TMS320 family.

Answer: Texas Instruments TMS320 is a blanket name for a series of digital signal processors (DSPs) from Texas Instruments. It was introduced on April 8, 1983 through the TMS32010 processor, which was then the fastest DSP on the market.

The processor is available in many different variants, some with fixed-point arithmetic and some with floating point arithmetic. The TMS320 processors were fabricated on MOS integrated circuit chips, including both NMOS and CMOS variants. The floating point DSP TMS320C3x, which exploits delayed branch logic, has as many as three delay slots.

The flexibility of this line of processors has led to it being used not merely as a co-processor for digital signal processing but also as a main CPU. Newer implementations support standard IEEE JTAG control for boundary scan and/or in-circuit debugging.

The original TMS32010 and its subsequent variants is an example of a CPU with a modified Harvard architecture, which features separate address spaces for instruction and data memory but the ability to read data values from instruction memory. The TMS32010 featured a fast multiply-and-accumulate operation useful in both DSP applications as well as transformations used in computer graphics. The graphics controller card for the Apollo Computer DN570 Workstation,

released in 1985, was based on the TMS32010 and could transform 20,000 2D vectors every second.

Variants

The TMS320 architecture has been around for a while so a number of product variants have developed. The product codes used by Texas Instruments after the first TMS32010 processor have involved a very popular series of processor named TMS320Cabcd where *a* is the main series, *b* the generation and *cd* is some custom number for a minor sub-variant.

For this reason people working with DSPs often abbreviate a processor as "C5x" when the actual name is something like TMS320C5510, since all products obviously have the name "TMS320" and all processors with "C5" in the name are code compatible and share the same basic features. Sometimes you will even hear people talking about "C55x" and similar subgroupings, since processors in the same series and same generation are even more similar.

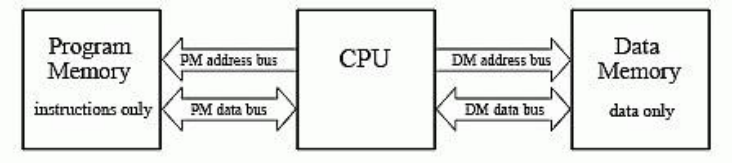
The TMS320 processors are fabricated on MOS integrated circuit chips, including both NMOS and CMOS variants.

Question – 3: Explain the following with reference to DSP processor-

a) **Harvard Architecture.**
b) **Von Neumann Architecture**

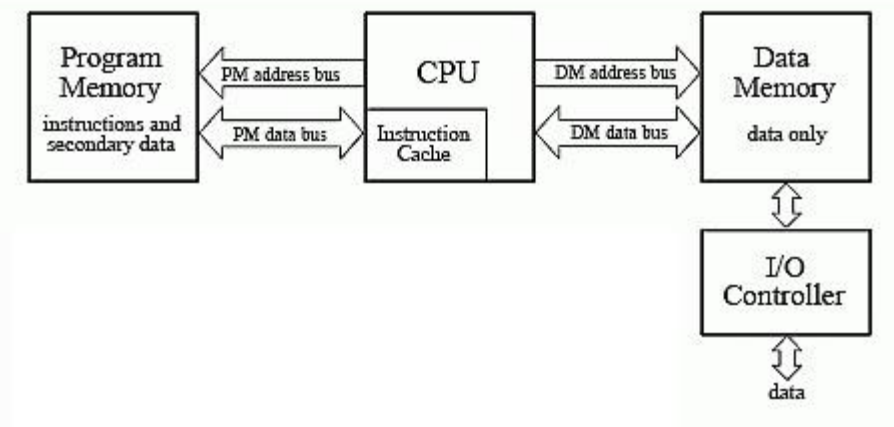
Answer: a) Harvard Architecture

The name of Harvard Architecture is taken for the work finished at Harvard University in the year the 1940s under the Howard Aiken leadership. As shown in this design, it includes two separate memories for both the data & program instructions including separate buses for each. When the buses work independently, then data & program instructions can be fetched together to improve the speed over the single bus. At present, this dual bus architecture is used by DSPs.



b) Super Harvard Architecture

The super Harvard architecture of DSP is shown below. This name was coined through Analog Devices to explain the internal function of their new ADSP-211xx & ADSP-2106x families of DSPs which are called SHARC DSP which is a reduction of the longer term of Super Harvard Architecture.



This architecture was implemented by including some features to increase the throughput. While the super Harvard architecture digital signal processors are optimized in several methods, two areas are significant enough to be included like an instruction cache & an I/O controller.