1. a) Explain why a MAC operation is implemented in hardware in programmable DSPs.

    b) Explain the difference between Von Neumann, Harvard and modified-Harvard architectures.
       Which architecture is preferred for DSP applications and why?

2. Explain what is meant by instruction pipelining. Explain with an example, how pipelining
    increases throughput efficiency.

3. a) What is meant by bit reversed addressing mode? What is the application for which this
       addressing mode is preferred?

    b) Explain about circular buffering with neat sketches.

4. Design a linear phase FIR filter with the response
    $$|H(e^{j\Omega})| = 1 \qquad \text{for } |\Omega| \le \pi/8$$
    $$= 0 \qquad \text{for } \pi/8 \le |\Omega| \le \pi$$
    Use Hamming window. The length of the impulse response is limited to 11. Draw the direct
    form structure of the filter.

5. Explain the frequency-domain characterization of down-sampler with neat sketches.

6. Explain the frequency-sampling technique of FIR filter design with an example.

7. Draw the pipelined MAC configuration and explain with neat timing diagrams.

8. Show that the *up-sampler* and *down-sampler* are linear time variant (LTV) systems.

9. An up-sampler, down-sampler and $X(\Omega)$ are depicted in figures (i) and (ii) respectively. Draw
    the spectrum of $y_u[n]$ and $y_d[n]$.

Fig(i)

Fig(ii)