S–81.2200 Sulautetut mikroprosessorijärjestelmät

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1. What is a *embedded system*, and what are the main characteristics of embedded systems that distinguish such systems from other computing systems?

2. Draw a block diagram of the *basic architecture of general-purpose processor* and explain the different phases of executing the following instruction sequence using that architecture.

```
0    MOV R1, Osoite_1
1    MOV R2, Osoite_2
2    ADD R1, R2
3    MOV Osoite_3, R1
```

   This particular instruction sequence adds the contents of memory locations `Osoite_1` and `Osoite_2` and transfers the sum to memory location `Osoite_3`.

3. Explain with a detailed block diagram and a numerical example the operation of a 4-bit analog-to-digital converter that uses the *successive approximations* principle. Why is a sample-and-hold circuit (*S/H*) used with that conversion principle?

4. Compare the *polling* and *vectored interrupt* principles in providing service to peripherals (*I/O*). Explain the operation of each principle, and give their advantages and disadvantages.

5. The following table shows a comparison of the characteristics of different types of memory. Fill in the missing data (grey boxes) to make the table complete.

Type	Volatile	Writeable	Erase size	Max erase cycles	Cost per byte	Speed
DRAM		Yes	Byte	Unlimited	Moderate	
EEPROM	No		Byte		Expensive	Fast to read, slow to erase/write
EPROM	No	Yes, with a device programmer		Limited (consult datasheet)	Moderate	Fast
Flash	No	Yes		Limited (consult datasheet)	Moderate	
Mask ROM	No	No	-	-		Fast
NVRAM		Yes	Byte		Expensive (SRAM + battery)	Fast
OTP ROM	No		-	-	Moderate	Fast
SRAM	Yes	Yes	Byte	Unlimited		Fast