1

2 Problems

1. Given a set of n (=2^m) registers (each of (word) length l bits) for some m = 0, 1, 2, . . . ,

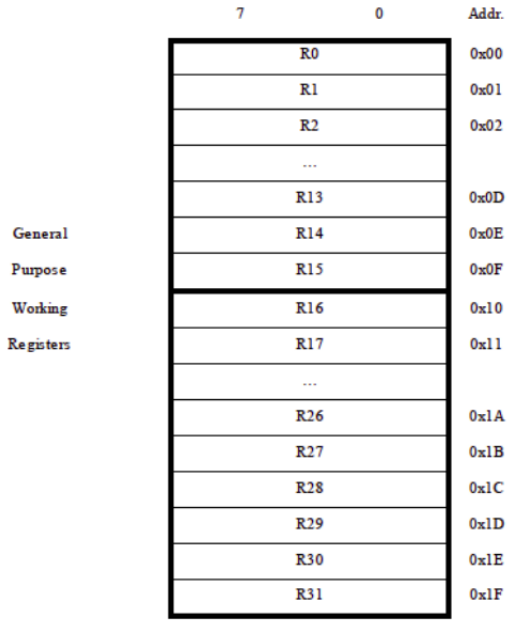
   Solution:

   (a) The minimum number of address bits ne essary to pick an unique register from the above set is $log_2(n) = m$. For example if $n = 2^2 = 4$ that is there are 4 registers then minimum number of address bits required are 2.

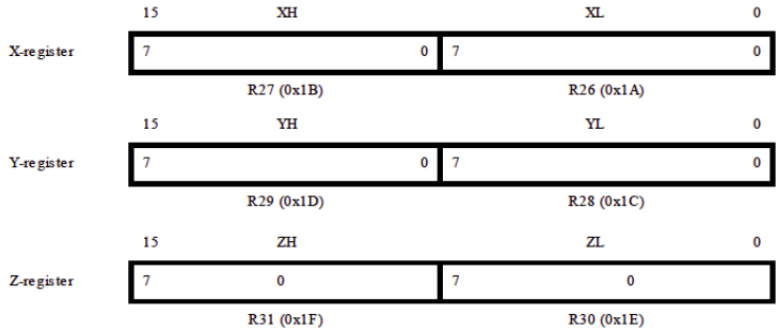
2. What is the size of (General Purpose) register memory (part of CU) in AVR? (Mention its size in terms of Bytes and its arrangement). What is the role of registers R26 through R31?

   Solution:

   The size of general purpose register is 8 bits. There are 32 general purpose registers. R0-R31 are the registers.



   The registers R26. . . R31 have some added functions to their general purpose usage. These registers are 16-bit address pointers for indirect addressing of the data space. The three indirect address registers X, Y, and Z are defined as described in the figure.



3. Consider the internal registers (internal to CU of a processor) of size l bits each and 'm' of them are available. If consecutive two such registers are used as a pointer to external memory (which might hold ode or data), what would be the maximum number of memory words it could uniquely address?

   Solution:

   It is give that the number of registers available are m each with size 1 bit. And two consecutive registers are used to point to an address. Assuming that data to be addressed is a byte (It is not neccesary that length is 8 bits or 1 byte). Following depicts memory structure in that particular external memory.

   1^{st} byte : 00

   2^{nd} byte: 01

   3^{rd} byte : 10

   ....

   If m is even then $\frac{m}{2}$ bytes can be addressed. (Here each bit in 2 bit is a register).

   If m is odd then $\frac{m-1}{2}$ can be addressed and one extra register is left.