What registers are used by the C compiler?

- **Data types:**
  `char` is 8 bits, `int` is 16 bits, `long` is 32 bits, `long` long is 64 bits, `float` and `double` are 32 bits (this is the only supported floating point format), pointers are 16 bits (function pointers are word addresses, to allow addressing the whole 128K program memory space on the ATmega devices with > 64 KB of flash ROM). There is a `-mint8` option (see Options for the C compiler avr-gcc) to make `int` 8 bits, but that is not supported by avr-libc and violates C standards (`int` *must* be at least 16 bits). It may be removed in a future release.

- **Call-used registers (r18-r27, r30-r31):**
  May be allocated by gcc for local data. You *may* use them freely in assembler subroutines. Calling C subroutines can clobber any of them - the caller is responsible for saving and restoring.

- **Call-saved registers (r2-r17, r28-r29):**
  May be allocated by gcc for local data. Calling C subroutines leaves them unchanged. Assembler subroutines are responsible for saving and restoring these registers, if changed. r29:r28 (Y pointer) is used as a frame pointer (points to local data on stack) if necessary. The requirement for the callee to save/preserve the contents of these registers even applies in situations where the compiler assigns them for argument passing.

- **Fixed registers (r0, r1):**
  Never allocated by gcc for local data, but often used for fixed purposes:

r0 - temporary register, can be clobbered by any C code (except interrupt handlers which save it), *may* be used to remember something for a while within one piece of assembler code

r1 - assumed to be always zero in any C code, *may* be used to remember something for a while within one piece of assembler code, but *must* then be cleared after use (`clr r1`). This includes any use of the `[f]mul[s[u]]` instructions, which return their result in r1:r0. Interrupt handlers save and clear r1 on entry, and restore r1 on exit (in case it was non-zero).

- **Function call conventions:**
  Arguments - allocated left to right, r25 to r8. All arguments are aligned to start in even-numbered registers (odd-sized arguments, including `char`, have one free register above them). This allows making better use of the `movw` instruction on the enhanced core.

If too many, those that don't fit are passed on the stack.

Return values: 8-bit in r24 (not r25!), 16-bit in r25:r24, up to 32 bits in r22-r25, up to 64 bits in r18-r25. 8-bit return values are zero/sign-extended to 16 bits by the caller (`unsigned char` is more efficient than `signed char` - just `clr r25`). Arguments to functions with variable argument lists (printf etc.) are all passed on stack, and `char` is extended to `int`.

Warning:
There was no such alignment before 2000-07-01, including the old patches for gcc-2.95.2. Check your old assembler subroutines, and adjust them accordingly.