

j1 ( <i>out</i> < 0)	j2 ( <i>out</i> = 0)	j3 ( <i>out</i> > 0)	Mnemonic	Effect
0	0	0	null	No jump
0	0	1	JGT	If <i>out</i> > 0 jump
0	1	0	JEQ	If <i>out</i> = 0 jump
0	1	1	JGE	If <i>out</i> ≥ 0 jump
1	0	0	JLT	If <i>out</i> < 0 jump
1	0	1	JNE	If <i>out</i> ≠ 0 jump
1	1	0	JLE	If <i>out</i> ≤ 0 jump
1	1	1	JMP	Jump

**Figure 4.5** The *jump* field of the *C*-instruction. *Out* refers to the ALU output (resulting from the instruction's *comp* part), and *jump* implies “continue execution with the instruction addressed by the A register.”

The last instruction (0;JMP) effects an unconditional jump. Since the *C*-instruction syntax requires that we always effect *some* computation, we instruct the ALU to compute 0 (an arbitrary choice), which is ignored.

**Conflicting Uses of the A Register** As was just illustrated, the programmer can use the A register to select either a *data memory* location for a subsequent *C*-instruction involving M, or an *instruction memory* location for a subsequent *C*-instruction involving a jump. Thus, to prevent conflicting use of the A register, in well-written programs a *C*-instruction that may cause a jump (i.e., with some non-zero j bits) should not contain a reference to M, and vice versa.

#### 4.2.4 Symbols

Assembly commands can refer to memory locations (addresses) using either constants or *symbols*. Symbols are introduced into assembly programs in the following three ways:

- *Predefined symbols:* A special subset of RAM addresses can be referred to by any assembly program using the following predefined symbols:
  - *Virtual registers:* To simplify assembly programming, the symbols R0 to R15 are predefined to refer to RAM addresses 0 to 15, respectively.
  - *Predefined pointers:* The symbols SP, LCL, ARG, THIS, and THAT are predefined to refer to RAM addresses 0 to 4, respectively. Note that each of these memory