## Non-floating Point Instructions

This section lists and describes the actions and formats of the non- floating point instructions of the Intel 80x86 CPU family.

The formats use the following abbreviations:

|  |  |
| --- | --- |
| R | general register |
| R8 | 8-bit register |
| R16 | 16-bit register |
| R32 | 32-bit register |
| SR | segment register |
| M | memory |
| M8 | byte |
| M16 | word |
| M32 | double word |
| I | immediate value |

These can be combined for the multiple operand instructions. For example, the format *R, R* means that the instruction takes two register operands. Many of the two operand instructions allow the same operands. The abbre- viation *O2* is used to represent these operands: *R,R R,M R,I M,R M,I*. If a 8-bit register or memory can be used for an operand, the abbreviation, *R/M8* is used.

The table also shows how various bits of the FLAGS register are affected by each instruction. If the column is blank, the corresponding bit is not affected at all. If the bit is always changed to a particular value, a 1 or 0 is shown in the column. If the bit is changed to a value that depends on the operands of the instruction, a *C* is placed in the column. Finally, if the bit is modified in some undefined way a *?* appears in the column. Because the

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only instructions that change the direction flag are CLD and STD, it is not listed under the FLAGS columns.

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| --- | --- | --- | --- |
| **Name** | **Description** | **Formats** | **Flags** |
| **O** | **S** | **Z** | **A** | **P** | **C** |
| ADC | Add with Carry | O2 | C | C | C | C | C | C |
| ADD | Add Integers | O2 | C | C | C | C | C | C |
| AND | Bitwise AND | O2 | 0 | C | C | ? | C | 0 |
| BSWAP | Byte Swap | R32 |  |  |  |  |  |  |
| CALL | Call Routine | R M I |  |  |  |  |  |  |
| CBW | Convert Byte to Word |  |  |  |  |  |  |  |
| CDQ | Convert Dword to |  |  |  |  |  |  |  |
|  | Qword |  |  |  |  |  |  |  |
| CLC | Clear Carry |  |  |  |  |  |  | 0 |
| CLD | Clear Direction Flag |  |  |  |  |  |  |  |
| CMC | Complement Carry |  |  |  |  |  |  | C |
| CMP | Compare Integers | O2 | C | C | C | C | C | C |
| CMPSB | Compare Bytes |  | C | C | C | C | C | C |
| CMPSW | Compare Words |  | C | C | C | C | C | C |
| CMPSD | Compare Dwords |  | C | C | C | C | C | C |
| CWD | Convert Word to |  |  |  |  |  |  |  |
|  | Dword into DX:AX |  |  |  |  |  |  |  |
| CWDE | Convert Word to |  |  |  |  |  |  |  |
|  | Dword into EAX |  |  |  |  |  |  |  |
| DEC | Decrement Integer | R M | C | C | C | C | C |  |
| DIV | Unsigned Divide | R M | ? | ? | ? | ? | ? | ? |
| ENTER | Make stack frame | I,0 |  |  |  |  |  |  |
| IDIV | Signed Divide | R M | ? | ? | ? | ? | ? | ? |
| IMUL | Signed Multiply | R M | C | ? | ? | ? | ? | C |
|  |  | R16,R/M16 |  |  |  |  |  |  |
|  |  | R32,R/M32 |  |  |  |  |  |  |
|  |  | R16,I |  |  |  |  |  |  |
|  |  | R32,I |  |  |  |  |  |  |
|  |  | R16,R/M16,I |  |  |  |  |  |  |
|  |  | R32,R/M32,I |  |  |  |  |  |  |
| INC | Increment Integer | R M | C | C | C | C | C |  |
| INT | Generate Interrupt | I |  |  |  |  |  |  |
| JA | Jump Above | I |  |  |  |  |  |  |
| JAE | Jump Above or Equal | I |  |  |  |  |  |  |
| JB | Jump Below | I |  |  |  |  |  |  |
| JBE | Jump Below or Equal | I |  |  |  |  |  |  |
| JC | Jump Carry | I |  |  |  |  |  |  |

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| --- | --- | --- | --- |
| **Name** | **Description** | **Formats** | **Flags** |
| **O** | **S** | **Z** | **A** | **P** | **C** |
| JCXZ | Jump if CX = 0 | I |  |  |  |  |  |  |
| JE | Jump Equal | I |
| JG | Jump Greater | I |
| JGE | Jump Greater or | I |
|  | Equal |  |
| JL | Jump Less | I |
| JLE | Jump Less or Equal | I |
| JMP | Unconditional Jump | R M I |
| JNA | Jump Not Above | I |
| JNAE | Jump Not Above or | I |
|  | Equal |  |
| JNB | Jump Not Below | I |
| JNBE | Jump Not Below or | I |
|  | Equal |  |
| JNC | Jump No Carry | I |
| JNE | Jump Not Equal | I |
| JNG | Jump Not Greater | I |
| JNGE | Jump Not Greater or | I |
|  | Equal |  |
| JNL | Jump Not Less | I |
| JNLE | Jump Not Less or | I |
|  | Equal |  |
| JNO | Jump No Overflow | I |
| JNS | Jump No Sign | I |
| JNZ | Jump Not Zero | I |
| JO | Jump Overflow | I |
| JPE | Jump Parity Even | I |
| JPO | Jump Parity Odd | I |
| JS | Jump Sign | I |
| JZ | Jump Zero | I |
| LAHF | Load FLAGS into AH |  |
| LEA | Load Effective Address | R32,M |
| LEAVE | Leave Stack Frame |  |
| LODSB | Load Byte |  |
| LODSW | Load Word |  |
| LODSD | Load Dword |  |
| LOOP | Loop | I |
| LOOPE/LOOPZ | Loop If Equal | I |
| LOOPNE/LOOPNZ | Loop If Not Equal | I |

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| --- | --- | --- | --- |
| **Name** | **Description** | **Formats** | **Flags** |
| **O** | **S** | **Z** | **A** | **P** | **C** |
| MOV | Move Data | O2 |  |  |  |  |  |  |
|  |  | SR,R/M16 |  |  |  |  |  |  |
|  |  | R/M16,SR |  |  |  |  |  |  |
| MOVSB | Move Byte |  |  |  |  |  |  |  |
| MOVSW | Move Word |  |  |  |  |  |  |  |
| MOVSD | Move Dword |  |  |  |  |  |  |  |
| MOVSX | Move Signed | R16,R/M8 |  |  |  |  |  |  |
|  |  | R32,R/M8 |  |  |  |  |  |  |
|  |  | R32,R/M16 |  |  |  |  |  |  |
| MOVZX | Move Unsigned | R16,R/M8 |  |  |  |  |  |  |
|  |  | R32,R/M8 |  |  |  |  |  |  |
|  |  | R32,R/M16 |  |  |  |  |  |  |
| MUL | Unsigned Multiply | R M | C | ? | ? | ? | ? | C |
| NEG | Negate | R M | C | C | C | C | C | C |
| NOP | No Operation |  |  |  |  |  |  |  |
| NOT | 1’s Complement | R M |  |  |  |  |  |  |
| OR | Bitwise OR | O2 | 0 | C | C | ? | C | 0 |
| POP | Pop From Stack | R/M16 |  |  |  |  |  |  |
|  |  | R/M32 |  |  |  |  |  |  |
| POPA | Pop All |  |  |  |  |  |  |  |
| POPF | Pop FLAGS |  | C | C | C | C | C | C |
| PUSH | Push to Stack | R/M16 |  |  |  |  |  |  |
|  |  | R/M32 I |  |  |  |  |  |  |
| PUSHA | Push All |  |  |  |  |  |  |  |
| PUSHF | Push FLAGS |  |  |  |  |  |  |  |
| RCL | Rotate Left with Carry | R/M,I | C |  |  |  |  | C |
|  |  | R/M,CL |  |  |  |  |  |  |
| RCR | Rotate Right with | R/M,I | C |  |  |  |  | C |
|  | Carry | R/M,CL |  |  |  |  |  |  |
| REP | Repeat |  |  |  |  |  |  |  |
| REPE/REPZ | Repeat If Equal |  |  |  |  |  |  |  |
| REPNE/REPNZ | Repeat If Not Equal |  |  |  |  |  |  |  |
| RET | Return |  |  |  |  |  |  |  |
| ROL | Rotate Left | R/M,I | C |  |  |  |  | C |
|  |  | R/M,CL |  |  |  |  |  |  |
| ROR | Rotate Right | R/M,I | C |  |  |  |  | C |
|  |  | R/M,CL |  |  |  |  |  |  |
| SAHF | Copies AH into |  |  | C | C | C | C | C |
|  | FLAGS |  |  |  |  |  |  |  |

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| --- | --- | --- | --- |
| **Name** | **Description** | **Formats** | **Flags** |
| **O** | **S** | **Z** | **A** | **P** | **C** |
| SAL | Shifts to Left | R/M,I |  |  |  |  |  | C |
|  |  | R/M, CL |  |  |  |  |  |  |
| SBB | Subtract with Borrow | O2 | C | C | C | C | C | C |
| SCASB | Scan for Byte |  | C | C | C | C | C | C |
| SCASW | Scan for Word |  | C | C | C | C | C | C |
| SCASD | Scan for Dword |  | C | C | C | C | C | C |
| SETA | Set Above | R/M8 |  |  |  |  |  |  |
| SETAE | Set Above or Equal | R/M8 |  |  |  |  |  |  |
| SETB | Set Below | R/M8 |  |  |  |  |  |  |
| SETBE | Set Below or Equal | R/M8 |  |  |  |  |  |  |
| SETC | Set Carry | R/M8 |  |  |  |  |  |  |
| SETE | Set Equal | R/M8 |  |  |  |  |  |  |
| SETG | Set Greater | R/M8 |  |  |  |  |  |  |
| SETGE | Set Greater or Equal | R/M8 |  |  |  |  |  |  |
| SETL | Set Less | R/M8 |  |  |  |  |  |  |
| SETLE | Set Less or Equal | R/M8 |  |  |  |  |  |  |
| SETNA | Set Not Above | R/M8 |  |  |  |  |  |  |
| SETNAE | Set Not Above or | R/M8 |  |  |  |  |  |  |
|  | Equal |  |  |  |  |  |  |  |
| SETNB | Set Not Below | R/M8 |  |  |  |  |  |  |
| SETNBE | Set Not Below or | R/M8 |  |  |  |  |  |  |
|  | Equal |  |  |  |  |  |  |  |
| SETNC | Set No Carry | R/M8 |  |  |  |  |  |  |
| SETNE | Set Not Equal | R/M8 |  |  |  |  |  |  |
| SETNG | Set Not Greater | R/M8 |  |  |  |  |  |  |
| SETNGE | Set Not Greater or | R/M8 |  |  |  |  |  |  |
|  | Equal |  |  |  |  |  |  |  |
| SETNL | Set Not Less | R/M8 |  |  |  |  |  |  |
| SETNLE | Set Not LEss or Equal | R/M8 |  |  |  |  |  |  |
| SETNO | Set No Overflow | R/M8 |  |  |  |  |  |  |
| SETNS | Set No Sign | R/M8 |  |  |  |  |  |  |
| SETNZ | Set Not Zero | R/M8 |  |  |  |  |  |  |
| SETO | Set Overflow | R/M8 |  |  |  |  |  |  |
| SETPE | Set Parity Even | R/M8 |  |  |  |  |  |  |
| SETPO | Set Parity Odd | R/M8 |  |  |  |  |  |  |
| SETS | Set Sign | R/M8 |  |  |  |  |  |  |
| SETZ | Set Zero | R/M8 |  |  |  |  |  |  |
| SAR | Arithmetic Shift to | R/M,I |  |  |  |  |  | C |
|  | Right | R/M, CL |  |  |  |  |  |  |

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| --- | --- | --- | --- |
| **Name** | **Description** | **Formats** | **Flags** |
| **O** | **S** | **Z** | **A** | **P** | **C** |
| SHR | Logical Shift to Right | R/M,I |  |  |  | C?? |  | C |
|  |  | R/M, CL |  |  |  |  |  |
| SHL | Logical Shift to Left | R/M,I |  |  |  |  | C |
|  |  | R/M, CL |  |  |  |  |  |
| STC | Set Carry |  |  |  |  |  | 1 |
| STD | Set Direction Flag |  |  |  |  |  |  |
| STOSB | Store Btye |  |  |  |  |  |  |
| STOSW | Store Word |  |  |  |  |  |  |
| STOSD | Store Dword |  |  |  |  |  |  |
| SUB | Subtract | O2 | C | C | C | C | C |
| TEST | Logical Compare | R/M,R | 0 | C | C | C | 0 |
|  |  | R/M,I |  |  |  |  |  |
| XCHG | Exchange | R/M,R |  |  |  |  |  |
|  |  | R,R/M |  |  |  |  |  |
| XOR | Bitwise XOR | O2 | 0 | C | C | C | 0 |