Table 2. Instruction Set Summary

DATA TRANSFER

MOV = Move:	76543210	76543210	76543210	76543210
Register/memory to/from register	100010dw	mod reg r/m		
Immediate to register/memory	1100011w	mod 000 r/m	data	data if w 1
Immediate to register	1011w reg	data	data if w 1	
Memory to accumulator	1010000w	addr-low	addr-high	
Accumulator to memory	1010001w	addr-low	addr-high	
Register/memory to segment register	10001110	mod 0 reg r/m		
Segment register to register/memory	10001100	mod 0 reg r/m		

PUSH = Push:		
Register/memory	11111111	mod 110 r/m
Register	01010 reg	
Segment register	000 reg 110	

POP = Pop:		
Register/memory	10001111	mod 000 r/m
Register	01011 reg	
Segment register	000 reg 111	

XCHG = Exchange:		
Register/memory with register	1000011w	mod reg r/m
Register with accumulator	10010 reg	

IN=Input from:		
Fixed port	1110010w	port
Variable port	1110110w	

OUT = Output to:		
Fixed port	1110011w	port
Variable port	1110111w	
XLAT=Translate byte to AL	11010111	
LEA=Load EA to register	10001101	mod reg r/m
LDS=Load pointer to DS	11000101	mod reg r/m
LES=Load pointer to ES	11000100	mod reg r/m
LAHF=Load AH with flags	10011111	
SAHF=Store AH into flags	10011110	
PUSHF=Push flags	10011100	
POPF=Pop flags	10011101	

ARITHMETIC

ADD = Add:				
Reg./memory with register to either	000000dw	mod reg r/m		
Immediate to register/memory	100000sw	mod 000 r/m	data	data if s w 01
Immediate to accumulator	0000010w	data	data if w 1	

ADC = Add with carry:				
Reg./memory with register to either	000100dw	mod reg r/m		
Immediate to register/memory	100000sw	mod 010 r/m	data	data if s w=01
Immediate to accumulator	0001010w	data	data if w=1	

INC = Increment:		
Register/memory	1111111w	mod 000 r/m
Register	01000 reg	
AAA=ASCII adjust for add	00110111	
DAA=Decimal adjust for add	00100111	

SUB = Subtract:				
Reg./memory and register to either	001010dw	mod reg r/m		
Immediate from register/memory	100000sw	mod101 r/m	data	data if s w=01
Immediate from accumulator	0010110w	data	data if w=1	

SBB = Subtract with borrow				
Reg./memory and register to either	000110dw	mod reg r/m		
Immediate from register/memory	100000sw	mod011 r/m	data	data if s w=01
Immediate from accumulator	0001110w	data	data if w=1	

DEC Decrement:	76543210	76543210	76543210	76543210
Register/memory	1111111w	mod001 r/m		
Register	01001 reg			
NEG Change sign	1111011w	mod011 r/m		

CMP Compare:				
Register/memory and register	001110dw	mod reg r/m		
Immediate with register/memory	100000sw	mod111 r/m	data	data if s w 01
Immediate with accumulator	0011110w	data	data if w 1	
AAS ASCII adjust for subtract	00111111			
DAS Decimal adjust for subtract	00101111			
MUL Multiply (unsigned)	1111011w	mod100 r/m		
IMUL Integer multiply (signed)	1111011w	mod101 r/m		
AAM ASCII adjust for multiply	11010100	00001010		
DIV Divide (unsigned)	1111011w	mod110 r/m		
IDIV Integer divide (signed)	1111011w	mod111 r/m		
AAD ASCII adjust for divide	11010101	00001010		
CBW Convert byte to word	10011000			
CWD Convert word to double word	10011001			

LOGIC

NOT Invert	1111011w	mod010 r/m		
SHL/SAL Shift logical/arithmetic left	110100vw	mod100 r/m		
SHR Shift logical right	110100vw	mod101 r/m		
SAR Shift arithmetic right	110100vw	mod111 r/m		
ROL Rotate left	110100vw	mod000 r/m		
ROR Rotate right	110100vw	mod001 r/m		
RCL Rotate through carry flag left	110100vw	mod010 r/m		
RCR Rotate through carry right	110100vw	mod011 r/m		

AND And:				
Reg./memory and register to either	001000dw	mod reg r/m		
Immediate to register/memory	1000000w	mod100 r/m	data	data if w 1
Immediate to accumulator	0010010w	data	data if w 1	

TEST And function to flags, no result:				
Register/memory and register	1000010w	mod reg r/m		
Immediate data and register/memory	1111011w	mod000 r/m	data	data if w 1
Immediate data and accumulator	1010100w	data	data if w 1	

OR Or:				
Reg./memory and register to either	000010dw	mod reg r/m		
Immediate to register/memory	1000000w	mod001 r/m	data	data if w 1
Immediate to accumulator	0000110w	data	data if w=1	

XOR Exclusive or:				
Reg./memory and register to either	001100dw	mod reg r/m		
Immediate to register/memory	1000000w	mod110 r/m	data	data if w 1
Immediate to accumulator	0011010w	data	data if w 1	

STRING MANIPULATION

REP=Repeat	1111001z
MOVS=Move byte/word	1010010w
CMPS=Compare byte/word	1010011w
SCAS=Scan byte/word	1010111w
LODS=Load byte/wd to AL/AX	1010110w
STOS=Stor byte/wd from AL/A	1010101w

Table 2. Instruction Set Summary (Continued)

CONTROL TRANSFER

CALL = Call:	76543210	76543210	76543210
Direct within segment	11101000	disp-low	disp-high
Indirect within segment	11111111	mod 010 r/m	
Direct intersegment	10011010	offset-low	offset-high
		seg-low	seg-high
Indirect intersegment	11111111	mod 011 r/m	

JMP = Unconditional Jump:			
Direct within segment	11101001	disp-low	disp-high
Direct within segment-short	11101011	disp	
Indirect within segment	11111111	mod 100 r/m	
Direct intersegment	11101010	offset-low	offset-high
		seg-low	seg-high
Indirect intersegment	11111111	mod 101 r/m	

RET = Return from CALL:			
Within segment	11000011		
Within seg. adding immed to SP	11000010	data-low	data-high
Intersegment	11001011		
Intersegment, adding immediate to SP	11001010	data-low	data-high
JE/JZ=Jump on equal/zero	01110100	disp	
JL/JNGE=Jump on less/not greater or equal	01111100	disp	
JLE/JNG=Jump on less or equal/not greater	01111110	disp	
JB/JNAE=Jump on below/not above or equal	01110010	disp	
JBE/JNA=Jump on below or equal/ not above	01110110	disp	
JP/JPE=Jump on parity/parity even	01111010	disp	
JO=Jump on overflow	01110000	disp	
JS=Jump on sign	01111000	disp	
JNE/JNZ=Jump on not equal/not zero	01110101	disp	
JNL/JGE=Jump on not less/greater or equal	01111101	disp	
JNLE/JG=Jump on not less or equal/ greater	01111111	disp	

	76543210	76543210
JNB/JAE=Jump on not below/above or equal	01110011	disp
JNBE/JA=Jump on not below or equal/above	01110111	disp
JNP/JPO=Jump on not par/par odd	01111011	disp
JNO=Jump on not overflow	01110001	disp
JNS=Jump on not sign	01111001	disp
LOOP Loop CX times	11100010	disp
LOOPZ/LOOPE=Loop while zero/equal	11100001	disp
LOOPNZ/LOOPNE=Loop while not zero/equal	11100000	disp
JCXZ=Jump on CX zero	11100011	disp

INT = Interrupt		
Type specified	11001101	type
Type 3	11001100	
INTO=Interrupt on overflow	11001110	
IRET=Interrupt return	11001111	

PROCESSOR CONTROL

CLC Clear carry	11111000	
CMC Complement carry	11110101	
STC Set carry	11111001	
CLD Clear direction	11111100	
STD Set direction	11111101	
CLI Clear interrupt	11111010	
STI Set interrupt	11111011	
HLT Halt	11110100	
WAIT Wait	10011011	
ESC Escape (to external device)	11011xxx	mod x x r/m
LOCK Bus lock prefix	11110000	

Footnotes

AL = 8-bit accumulator
AX = 16-bit accumulator
CX = Count register
DS = Data segment
ES = Extra segment
Above/below refers to unsigned value.
Greater = more positive;
Less = less positive (more negative) signed values
if d = 1 then "to" reg; if d = 0 then "from" reg
if w = 1 then word instruction; if w = 0 then byte instruction

if mod = 11 then r/m is treated as a REG field
if mod = 00 then DISP = 0*, disp-low and disp-high are absent
if mod = 01 then DISP = disp-low sign-extended to 16-bits, disp-high is absent
if mod = 10 then DISP = disp-high: disp-low

if r/m = 000 then EA = (BX) + (SI) + DISP
if r/m = 001 then EA = (BX) + (DI) + DISP
if r/m = 010 then EA = (BP) + (SI) + DISP
if r/m = 011 then EA = (BP) + (DI) + DISP
if r/m = 100 then EA = (SI) + DISP
if r/m = 101 then EA = (DI) + DISP
if r/m = 110 then EA = (BP) + DISP*
if r/m = 111 then EA = (BX) + DISP

DISP follows 2nd byte of instruction (before data if required)

*except if mod = 00 and r/m = 110 then EA = disp-high: disp-low.

if s:w = 01 then 16 bits of immediate data form the operand.
if s:w = 11 then an immediate data byte is sign extended to form the 16-bit operand.
if v = 0 then "count" = 1; if v = 1 then "count" in (CL)
x = don't care
z is used for string primitives for comparison with Z.F FLAG.

SEGMENT OVERRIDE PREFIX

0 0 1 reg 1 1 0

REG is assigned according to the following table:

16-Bit (w = 1)	8-Bit (w = 0)	Segment
000 AX	000 AL	00 ES
001 CX	001 CL	01 CS
010 DX	010 DL	10 SS
011 BX	011 BL	11 DS
100 SP	100 AH	
101 BP	101 CH	
110 SI	110 DH	
111 DI	111 BH	

Instructions which reference the flag register file as a 16-bit object use the symbol FLAGS to represent the file:

FLAGS = X:X:X:X:(OF):(DF):(IF):(TF):(SF):(ZF):X:(AF):X:(PF):X:(CF)