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COMPARE OPERATIONS

Compare instructions are provided to test specified relations between two numeric quantities and to provide byte testing capabilities.

The effect of the compare instructions is to set a bit called a condition bit. Twenty-four condition bits are provided and are grouped together to form special register S^0 . The individual condition bits are identified as c_0 , c_1 ,..., c_{23} .

The compare instructions have the following formats:

(I) op i j k

(II) op i j h

The compare is done between the contents of registers R^j and R^k in format I and between the contents register X^j and the literal h in format II. In both formats the i field designates the bit (or bits) of the condition register which is to be set.

If a compare contains an i field greater than 23, that is, specifies a nonexistent condition bit, the result of the compare is lost. However, if an attempt is made to set c_{24} to 0, or c_{25} to 1, the condition check exception signal CC is generated.

Although only two basic numerical comparison relations are provided in the instruction set (greater than or equal to, and equal to), all six possible relations can be tested either by interchanging the names in the j- and k-fields or by using the negation of the test result. Specifically:

Basic relation to test	Test for	Basic relation true if condition bit has value
	1030101	condition of has value
a > b	b≥a	0
a≥b	a≥b	1
a = b	a = b	1
a≠b	a = b	0
a≤b	b≥a	1
a < b	a≥b	O

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In the floating point arithmetic section a bit configuration is defined to represent floating point numbers in the exponent overflow range. These numbers are symbolized by u and have the configuration of a 1 in bit zero and 0's in the remaining bits. When one or both operands are u in any of the floating point comparison operations, the result of the compare is made false (0).

The floating point compare operations may give an incorrect result if either or both operands are unnormalized. If either operand is unnormalized, the UO (unnormalized operand) exception bit is set to 1.

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Compare, Greater or Equal, Normalized

CGEN

i j k

The normalized single precision floating point numbers in A^j and A^k are compared. If the number in A^j is greater than or equal to the number in A^k , condition bit c_i is set to 1; otherwise c_i is set to 0.

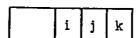
For the special case when either or both operands are u, condition bit c_i is set to 0.

This instruction may give an incorrect result if either or both operands are unnormalized.

Exceptions	Exception bit
unnormalized operand	UO
c ₂₄ set to 0 or c ₂₅ set to 1	CC

Compare, Equal, Normalized

CEQN



The normalized single precision floating point numbers in A^j and A^k are compared. If the numbers are equal, condition bit c_i is set to 1; otherwise c_i is set to 0.

For the special case when either or both operands are u,condition bit $\mathbf{c_i}$ is set to 0.

This instruction may give an incorrect result if either or both operands are unnormalized.

Exceptions	Exception bit
unnormalized operand	uо
${ m c}_{24}$ set to 0 or ${ m c}_{25}$ set to 1	CC

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Compare, Greater or Equal, Double

CGED

i j k

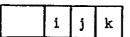
The normalized double precision floating point numbers in Aj, j+1 and Ak, k+1 are compared. If the number in Aj, j+1 is greater than or equal to the number in Ak, k+1, condition bit c_i is set to 1; otherwise c_i is set to 0. The values of the j- and k-fields are assumed to be even.

For the special case when either or both operands are u, condition bit c_i is set to 0.

Exceptions	Exception bit
unnormalized operand	UO
${f c}_{24}$ set to 0 or ${f c}_{25}$ set to 1	CC
j or k odd	RS

Compare, Equal, Double

CEQD



The normalized double precision floating point numbers in $A^{j,j+1}$ and $A^{k,k+1}$ are compared. If the numbers are equal, condition bit c_i is set to 1; otherwise c_i is set to 0. The values of the j- and k-fields are assumed to be even.

For the special case when either or both operands are u, condition bit c_i is set to 0.

Exceptions	Exception bit
unnormalized operand	UO
${ m c}_{24}$ set to 0 or ${ m c}_{25}$ set to 1	CC
j or k odd	RS

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Compare Magnitude, Greater or Equal, Normalized

CMGEN

i j k

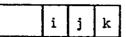
The magnitudes of the normalized single precision floating point numbers in A^j and A^k are compared. If the magnitude of the number in A^j is greater than or equal to the magnitude of the number in A^k , condition bit c_i is set to 1. Otherwise c_i is set to 0.

For the special case when either or both operands are u, condition bit c_i is set to Q.

This instruction may give an incorrect result if either or both operands are unnormalized.

Exceptions	Exception bit
unnormalized operand	UO
\mathtt{c}_{24} set to 0 or \mathtt{c}_{25} set to 1	CC

Compare Magnitude, Equal, Normalized CMEQN



The magnitudes of the normalized single precision floating point numbers in Aj and Ak are compared. If the magnitudes of the numbers are equal, condition bit c_i is set to 1. Otherwise c_i is set to 0.

For the special case when either or both operands are u, condition bit c, is set to 0.

This instruction may give an incorrect result if either or both operands are unnormalized.

Exceptions	Exception bit
unnormalized operand	UO
${ t c}_{24}^{}$ set to 0 or ${ t c}_{25}^{}$ set to 1	CC

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Compare Magnitude Double, Greater or Equal

CMGED

i j k

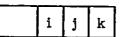
The magnitudes of the normalized double precision floating point numbers in $A^{j,j+1}$ and $A^{k,k+1}$ are compared. If the magnitudes of the number in $A^{j,j+1}$ is greater than or equal to the magnitude of the number in $A^{k,k+1}$, condition bit c_i is set to 1. Otherwise, c_i is set to 0. The values of the j- and k-fields are assumed to be even.

For the special case when either or both operands are u, condition bit c_i is set to 0.

Exceptions	Exception bit
unnormalized operand	UO
$\mathtt{c}_{24}^{}$ set to 0 or $\mathtt{c}_{25}^{}$ set to 1	CC
j or k odd	RS

Compare Magnitude Double, Equal

CMEQD



The magnitudes of the normalized double precision floating point numbers in A^j , j+1 and A^k , k+1 are compared. If the magnitudes of the numbers are equal, condition bit c_i is set to 1. Otherwise, c_i is set to 0. The values of the j- and k-fields are assumed to be even.

For the special case when either or both operands are u, condition bit $\mathbf{c_i}$ is set to 0.

Exceptions	Exception bit
unnormalized operand	UO
$\mathtt{c}_{24}^{}$ set to 0 or $\mathtt{c}_{25}^{}$ set to 1	CC
j or k odd	RS

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Compare, Greater or Equal, Integer	CGEI	i j k	
The single precision integers in A^j and A or equal to the number in A^k , condition b	k are compared. it c_i is set to 1;	If the number in A^{j} is greater otherwise c_{i} is set to 0.	than
Exception		Exception bit	
$\mathtt{c}_{24}^{}$ set to 0 or $\mathtt{c}_{25}^{}$ set to 1		CC	
Compare, Equal, Integer The single precision integers in A ^j and A bit c _i is set to 1; otherwise c _i is set to 0.	CEQI [i j k If the numbers are equal, con	dition
Exception		Exception bit	
$\mathtt{c}_{24}^{}$ set to 0 or $\mathtt{c}_{25}^{}$ set to 1		CC	
Compare Unsigned, Greater or Equal, Integer The contents of registers Aj and Ak are c in Aj is greater than or equal to the numb set to 0.	CUGEI Considered as 48-er in A ^k , condit	i j k bit unsigned integers. If the maion bit c _i is set to 1; otherwise of	mber c _i is
Exception		Exception bit	

CC

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 \mathbf{c}_{24} set to 0 or \mathbf{c}_{25} set to 1

ADVANCED COMPUTING SYSTEMS IBM REGISTERED CONFIDENTIAL ACS-I Development Workbook Volume Page: 6-8 Chapter 02 Date: 1/8/68 Section Appendix Compare, Greater or Equal, Index **CGEX** The index integers in X^j and X^k are compared. If the number in X^j is greater than or equal to the number in X^k , condition bit c_i is set to 1; otherwise c_i is set to 0. Exception Exception bit c_{24} set to 0 or c_{25} set to 1 CC Compare, Equal, Index CEQX k The index integers in \mathbf{X}^{j} and \mathbf{X}^{k} are compared. If the numbers are equal, condition bit \mathbf{c}_{i} is set to 1; otherwise c, is set to 0. Exception Exception bit c_{24} set to 0 or c_{25} set to 1 CC Compare Unsigned, Greater or CUGEX

The contents of registers X^j and X^k are considered as 24-bit unsigned integers. If the number in X^j is greater than or equal to the number in X^k , condition bit c_i is set to 1; otherwise c_i is set to 0.

Exception

Equal, Index

Exception bit

 c_{24} set to 0 or c_{25} set to 1

CC

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Compare Index with Constant, Greater or Equal	CGEXK	i j h	
The index integers in X^j and in the literal than or equal to the number in the h-field	l h-field are o	compared. If the number in X^{j} is greated to c _i is set to 1; otherwise, c _i is set to 0.	r
Exception		Exception bit	
$\mathtt{c}_{24}^{}$ set to 0 or $\mathtt{c}_{25}^{}$ set to 1		CC	
Compare Index with Constant, Equal The index integers in X ^j and in the literal condition bit c, is set to 1; otherwise, c,	CEQXK . h-field are o	i j h compared. If the numbers are equal,	
Exception		Exception bit	
$c_{24}^{}$ set to 0 or $c_{25}^{}$ set to 1		CC	
Compare Unsigned Index with Constant, Greater or Equal The contents of register X ^j and the literal If the number in X ^j is greater than or equ to 1; otherwise c _j is set to 0.	CUGEXK I h-field are o al to the num	i j h considered as 24-bit unsigned integers. ber in the h-field, condition bit c _i is set	
Exception		Exception bit	
${ m c}_{24}$ set to 0 or ${ m c}_{25}$ set to 1		CC	

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Compare	Bytes,	Arithmetic

CBA

i j k

The 48-bit contents of register A^k are considered as six 8-bit operand bytes: the first byte is $A^k_{0,1,\ldots,7}$; the second byte is $A^k_{8,9,\ldots,15}$; and so on. The low order 8 bits of register A^j are considered as one test byte. The test byte is compared with each of the six operand bytes.

Condition bit c_i is set to 1 if the test byte is identical to one or more of the operand bytes; it is set to 0 if the test byte is not identical to any operand byte.

Exception

Exception bit

 $c_{24}^{}$ set to 0 or $c_{25}^{}$ set to 1

CC

Compare Bytes, Multiple, Arithmetic

CBMA

 i	j	k
•	4	

The 48-bit contents of register A^k are considered as six 8-bit operand bytes: the first byte is $A^k_{0,1,\ldots,7}$; the second byte is $A^k_{8,9,\ldots,15}$; and so on. The low order 8 bits of register A^j are considered as one test byte. The test byte is compared with each of the six operand bytes.

Condition bit c_i is set to 1 if the test byte is identical to one or more of the operand bytes; it is set to 0 if the test byte is not identical to any operand byte.

Condition bit c_{i+1} is set to 1 or 0 according as the test byte is identical to the first operand byte or not; bit c_{i+2} is set to 1 or 0 according as the test byte is identical to the second operand byte or not; and so on through bit c_{i+6} .

Only the leading two bits of the i-field of the instruction are interpreted to determine which condition bits are set, thereby effectively partitioning the condition register into segments: bits 0 to 6, bits 8 to 14, bits 16 to 22, and bits 24 to 30.

Exception

Exception bit

 c_{24} set to 0 or c_{25} set to 1

CC

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Compare Bytes, Index

CBX

i j k

The 24-bit contents of register X^k are considered as three 8-bit operand bytes: the first byte is $X_{0,1,\ldots,7}^k$; the second byte is $X_{8,9,\ldots,15}^k$; and so on. The low order 8 bits of register X^k are considered as one test byte. The test byte is compared with each of the three operand bytes.

Condition bit c_i is set to 1 if the test byte is identical to one or more of the operand bytes; it is set to 0 if the test byte is not identical to any operand byte.

Exception.

Exception bit

 c_{24} set to 0 or c_{25} set to 1

CC

Compare Bytes, Multiple, Index

CBMX

*			I , I	
	1 1]	K	
1			ıl	

The 24-bit contents of register X^k are considered as three 8-bit operand bytes: the first byte is $X_{0,1,\ldots,7}^k$; the second byte is $X_{8,9,\ldots,15}^k$; and so on. The low order 8 bits of register X^j are considered as one test byte. The test byte is compared with each of the three operand bytes.

Condition bit c_i is set to 1 if the test byte is identical to one or more of the operand bytes; it is set to 0 if the test byte is not identical to any operand byte.

Condition bit c_{i+1} is set to 1 or 0 according as the test byte is identical to the first operand byte or not; bit c_{i+2} is set to 1 or 0 according as the test byte is identical to the second operand byte or not; and bit c_{i+3} is set to 1 or 0 according as the test byte is identical to the third operand byte or not.

Only the leading three bits of the i-field of the instruction are interpreted to determine which condition bits are set, thereby effectively partitioning the condition register into segments: bits 0 to 3, bits 4 to 7, and so on.

Exception

Exception bit

 \mathbf{c}_{24} set to 0 or \mathbf{c}_{25} set to 1

CC