|  |
| --- |
| CISC CODE |
| START ADD A, B, C |
| ADD D, E, F |
| ADD C, F, G |
| BRZ ISZERO |
| BRN ISNEG |
| ADD F, G, C |
| BR END |
| ISZERO ADD F, J, C |
| BR END |
| ISNEG ADD G, J, C |
| END STOP |

**LAB4-CH13- ORIGINAL CICS SOURCE CODE**

**STEP1 CISC to RISC**

|  |  |  |
| --- | --- | --- |
| LABEL | OPERATION | OPERANDS |
| START | LR1 | A |
|  | LR2 | B |
|  | ADD | R1,R2,R3 |
|  | STR3 | C |
|  | LR1 | D |
|  | LR2 | E |
|  | ADD | R1,R2,R2 |
|  | STR2 | F |
|  | LR3 | C |
|  | LR2 | F |
|  | ADD | R3,R2,R1 |
|  | STR1 | G |
|  | BRZ | ISZERO |
|  | BRN | ISNEG |
|  | LR2 | F |
|  | LR1 | G |
|  | ADD | R2,R1,R3 |
|  | STR3 | C |
|  | BR | END |
| ISZERO | LR2 | F |
|  | LR1 | J |
|  | ADD | R2,R1,R3 |
|  | STR3 | C |
|  | BR | END |
| ISNEG | LR1 | G |
|  | LR2 | J |
|  | ADD | R2,R1,R3 |
|  | STR3 | C |
| END | STOP |  |
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**STEP2a Register Time Usage and renaming and load/store change/removal**

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| --- | --- | --- | --- | --- | --- |
| LABEL | OPERATION | OPERANDS | R1 | R2 | R3 |
| START | LR1 | A | A |  |  |
|  | LR2 | B |  | B |  |
|  | ADD | R1,R2,R3 |  |  | **C** |
|  | ~~STR3~~ | ~~C~~ |  |  |  |
|  | LR1 | D | D |  |  |
|  | LR2 | E |  | E |  |
|  | ADD | R1,R2,R2 |  | **F** |  |
|  | ~~STR2~~ | ~~F~~ |  |  |  |
|  | LR3 | C |  |  | C |
|  | LR2 | F |  | F |  |
|  | ADD | R3,R2,R1 | **G** |  |  |
|  | ~~STR1~~ | ~~G~~ |  |  |  |
|  | BRZ | ISZERO |  |  |  |
|  | BRN | ISNEG |  |  |  |
|  | ~~LR2~~ | ~~F~~ | ~~F~~ |  |  |
|  | ~~LR1~~ | ~~G~~ |  | ~~G~~ |  |
|  | ADD | R2,R1,R3 |  |  | **C** |
|  | ~~STR3~~ | ~~C~~ |  |  |  |
|  | BR | END |  |  |  |
| ISZERO | ~~LR2~~ | ~~F~~ |  | ~~F~~ |  |
|  | LR1 | J | J |  |  |
|  | ADD | R2,R1,R3 |  |  | **C** |
|  | ~~STR3~~ | ~~C~~ |  |  |  |
|  | BR | END |  |  |  |
| ISNEG | LR2 | J |  | J |  |
|  | ~~LR1~~ | ~~G~~ | ~~G~~ |  |  |
|  | ADD | R1,R2,R3 |  |  | **C** |
|  | ~~STR3~~ | ~~C~~ |  |  |  |
| END | STOP |  |  |  |  |
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**STEP2b Final OPTIMIZED CODE**

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| --- | --- | --- | --- | --- | --- |
| LABEL | OPERATION | OPERANDS | R1 | R2 | R3 |
| START | LR1 | A | A |  |  |
|  | LR2 | B |  | B |  |
|  | ADD | R1,R2,R3 |  |  | **C** |
|  | LR1 | D | D |  |  |
|  | LR2 | E |  | E |  |
|  | ADD | R1,R2,R2 |  | **F** |  |
|  | LR3 | C |  |  | C |
|  | LR2 | F |  | F |  |
|  | ADD | R3,R2,R1 | **G** |  |  |
|  | BRZ | ISZERO |  |  |  |
|  | BRN | ISNEG |  |  |  |
|  | ADD | R2,R1,R3 |  |  | **C** |
|  | BR | END |  |  |  |
| ISZERO | LR1 | J | J |  |  |
|  | ADD | R2,R1,R3 |  |  | **C** |
|  | BR | END |  |  |  |
| ISNEG | LR2 | J |  | J |  |
|  | ADD | R1,R2,R3 |  |  | **C** |
| END | STOP |  |  |  |  |
|  |  |  |  |  |  |

CISC CODE RESULTS for 3 sets of VARIABLE VALUES

|  |  |  |  |
| --- | --- | --- | --- |
| CISC CODE | 1: A=1, B=2, D=3, E=4, J=1 | 2: A=1, B=2, D=3, E=-6, J=1 | 3: A=1, B=2, D=3, E=-8, J=1 |
| START ADD A, B, C | C=3 | C=3 | C=3 |
| ADD D, E, F | F=7 | F=-3 | F=-5 |
| ADD C, F, G | G=10 | G=0 | G=-2 |
| BRZ ISZERO | NOT TAKEN | TAKEN | NOT TAKEN |
| BRZ ISNEG | NOT TAKEN |  | TAKEN |
| ADD F, G, C | C=17 |  |  |
| BR END | TAKEN |  |  |
| ISZERO ADD F, J, C |  | C=-2 |  |
| BR END |  | TAKEN |  |
| ISNEG ADD G, J, C |  |  | C=-1 |
| END STOP |  |  |  |
| **FINAL VALUES**> | **C=17, F=7, G=10** | **C=-2, F=-3, G=0** | **C=-1, F=-5, G=-2** |

OPTIMIZED RISC CODE RESULTS for 3 sets of VARIABLE VALUES

|  |  |  |  |
| --- | --- | --- | --- |
| OPTIMIZED RISC CODE | 1: A=1, B=2, D=3, E=4, J=1 | 2: A=1, B=2, D=3, E=-6, J=1 | 3: A=1, B=2, D=3, E=-8, J=1 |
| START LR1 A |  |  |  |
| LR2 B |  |  |  |
| ADD R1, R2, R3 | R3=3 | R3=3 | R3=3 |
| LR1 D |  |  |  |
| LR2 E |  |  |  |
| ADD R1, R2, R2 | R2=7 | R2=-3 | R2=-5 |
| LR3 C |  |  |  |
| LR2 F |  |  |  |
| ADD R3, R2, R1 | R1=10 | R1=0 | R1=-2 |
| BRZ ISZERO | NOT TAKEN | TAKEN | NOT TAKEN |
| BRZ ISNEG | NOT TAKEN |  | TAKEN |
| ADD R2, R1, R3 | R3=17 |  |  |
| BR END | TAKEN |  |  |
| ISZERO LR1 J |  |  |  |
| ADD R2, R1, R3 |  | R3=-2 |  |
| BR END |  | TAKEN |  |
| ISZERO LR2 J |  |  |  |
| ADD R1, R2, R3 |  |  | R3=-1 |
| END STOP |  |  |  |
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|  |  |  |  |
| **FINAL VALUES>** | **C=17, F=7, G=10** | **C=-2, F=-3, G=0** | **C=-1, F=-5, G=-2** |