MIPS Single Cycle Processor Emulator Project

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Description

In this project, you will create a simple MIPS simulator. Your simulator will read a binary file containing a MIPS program and execute that program. This will occur in two steps. First, your program will generate the assembly code for the given MIPS program (disassembler). Second, your program will create an instruction-by-instruction simulation of the MIPS program. This simulation will execute instructions sequentially (non-pipelined) and output the contents of all registers and memory (the state of the processor and memory) after each instruction. You will not have to implement exception/interrupt handling

You will be given the expected output for each input program. Your output **must exactly match the expected output**. The program will be graded simply by using the `diff` program. The `diff` program simply lists the differences between two files. Your output should have no differences with the expected output. We will suppress white space differences, so if you have a space instead of a tab, that is OK.

The command to run diff and suppress white space differences is the following:

```
diff -w
```

Your disassembler can be reused for the next project, so try to write it in a way such that you can separate it from your code to execute the program. In fact, it is easier to write and debug the disassembler first, then write the emulation portion of the project.

Implementation

You may implement this project in any programming language of your choosing. You MUST include instructions in a README file that indicate how to compile (if necessary) and run your program. You MUST include a makefile to compile the code if it is in a language that requires compilation. Examples are linked on the course web site. Your code will be graded on linux on the home server. The only reason it will not be graded there is if you use such an obscure language that home does not have the correct compilers/interpreters for it. C/C++, and Java program must be able to run on home. You may develop locally, then test on home at the end. This program should require NO system libraries, except I/O, so there should be no trouble.

Details

Refer to the MIPS instruction set architecture PDF that is posted along with the course notes on the course website. It provides the details for all MIPS instructions. **NOTE that we are making the following changes to the instruction set architecture:**

Instead of a 6 bit opcode, we will use a 5 bit opcode that is preceded by a valid bit. The valid bit will be set to 1 if the instruction is valid and should be executed. If the valid bit is set to 0, then the instruction has no effect (it is effectively a NOP). The opcodes will be the same as those in the MIPS instruction set, just ignore the most significant bit (the first bit). We will not change the functionality of any instruction, simply we use this convention for the opcode. The table below illustrates this change:

Bit 31	Bits 30 - 26	Bits 25 - 0
Valid bit	Opcode	The rest of the instruction

A suggestion to make coding the program easier. First, read the entire file and simply print if each instruction is valid or not. This will force you to get the general structure of the disassembler in place and debugged before you begin the more complicated step of disassembly.

You will be given an input file containing a sequence of 32 bit instruction words. Assume that the first instruction is at memory address 96. The final instruction in an instruction sequence is ALWAYS a "BREAK" instruction. Following the break instruction is a sequence of 32 bit 2's compliment signed integers for the program data. These continue until the end of file.

Your simulator/disassembler must support the following MIPS instructions. Check the MIPS manual for details on instruction representation and operation for each instruction.

```
J, JR, BEQ, BLTZ
ADD, ADDI, SUB
SW, LW
SLL, SRL
MUL,
AND, OR,
MOVZ
NOP
```

Input

Your program must accept command line arguments for execution. The following arguments must be supported (Executable named "mipssim"):

```
mipssim -i INPUTFILENAME -o OUTPUTFILENAME
```

Your program will produce 2 output files. One named OUTPUTFILE-NAME_sim.txt, which contains the simulation output, and one named OUTPUTFILENAME_dis.txt, which contains the disassembled program code for the input MIPS program.

Your program will be graded both with the sample input and output provided to you, and with input and output that is not provided to you. It is recommended you construct your own input programs for testing.

Output

Your program will produce 2 output files.

- One named OUTPUTFILENAME_sim.txt, which contains the simulation output

- One named OUTPUTFILENAME_dis.txt, which contains the disassembled program code for the input MIPS program.

The disassembled output file should contain one line per word in the input file. It should be separated into 4 columns, each separated by **tab character**. The columns contain the following information:

1. The binary representation of the instruction word. If the word is an instruction (as opposed to memory data after the BREAK instruction), the instruction should be split into seven groups of digits: the valid bit, the opcode bits, four groups of 5 bits, and a final group of 6 bits.

2. The address of the memory location (in decimal)

3. The disassembled instruction opcode

4. If it is an instruction, print the operation, followed by a tab character, then print each argument separated by a comma and a space (", ").

The simulation file must have the following format:

- 20 equal signs and a newline

- cycle: [cycle number] [tab] [instruction address] [tab] [instruction string (same as step 4 above)]

- [blank lane]

- registers:

- r00: [tab] [integer value of R00][tab] [integer value of R01][tab] ... [integer value of R07]

- r08: [tab] [integer value of R08][tab] [integer value of R09][tab] ... [integer value of R15]

- r16: [tab] [integer value of R16][tab] [integer value of R17][tab] ... [integer value of R23]

- r24: [tab] [integer value of R24][tab] [integer value of R25][tab] ... [integer value of R31]

- [blank line]

- [data address]: [tab] [show 8 data words, with tabs in between]

- ... [continue until last data word]

Hint: Spend some time creating an output function or class or module or whatever fits your language of choice that handles printing out the various data in this format. Spending a little time to do it right in the beginning will save you a lot of time later. Another hint, the register file and memory can simply be implemented as arrays. Go ahead and make them global variables so you don't have to pass them around to a bunch of functions. This just makes the code a little more simple to write.

Instructions and arguments should be in capital letters. All integer values should be in decimal. Immediate values should be preceded by a # sign. Be careful and consider which instructions take signed values and which take unsigned values. Be sure to use the correct format depending on the context.

You output will be graded with the `diff` command. Test your output against the provided sample outputs! Any differences reported by the `diff` command are assumed to be incorrect output!

Sample files will be provided with the following extensions:

- .c – C code

- .mips – the compiled version of the C code

- .bin – the binary version of the .mips file

- sample output files

- a file named similar to sample_bin.txt which is a text version of the .bin file for your reference. Note that your program must accept the .bin file, not the text version.

What to Turn In

1. Your source files, in ZIP or TAR format.

2. A README file in PLAIN TEXT FORMAT that contains the names and email addresses of your group members and instructions for compiling and running your program. **The README file should NOT have a file extension (e.g., .txt)**.

3. A **MAKEFILE** that will compile your program using the default make target (all:).

You may use any programming language you like. If your language of choice is NOT available on the home server, you must demo it to me in my office. **The executable must be named "mipssim"** once the program is compiled. If your programming language uses an interpreter to execute the program, indicate that in the README file. DO NOT turn in any sample input files or any previously generated output files.

Grading

A valid attempt at the project that compiles and produces some output is worth 70 points. Each produced disassembly and simulation file is worth 5 points. There are 3 bin files from which 3 disassembly files are produced and 3 simulation files.

You will receive 5 points for a produced file if it matches the provided file EXACTLY (with the exception of white space differences).

Programs that do not compile or that do not produce any output will get 0 points. If you do not follow the directions in regards to command line arguments or expected behavior, the penalty is at the discretion of the grader.

Input and Expected Output

The remainder of the document contains PDF versions of the expected output. The input files and text files of the expected output will be available on the course webpage. The final two pages of this document contain programs to convert text files containing binary strings to binary files, and vice versa. Use those programs to develop your own MIPS executables for debugging and testing.

Note that your program MUST USE A BINARY FILE AS INPUT. The test1 example contains a text representation of the input file as well as the c version of the program. These are there for informational purposes only. Your program only needs to read the binary file and produce the disassembled file and simulation file.

```cpp
#include <iostream>
#include <unistd.h>
#include <fcntl.h>
#include <iomanip>
using namespace std;

int main()
{
        char buffer[4];
        int i;
        char * iPtr;
        iPtr = (char*)(void*) &i;

        int FD = open("test2.bin", O_RDONLY);

        int amt = 4;
        while( amt != 0 )
        {
                amt = read(FD, buffer, 4);
                if( amt == 4)
                {
                        iPtr[0] = buffer[3];
                        iPtr[1] = buffer[2];
                        iPtr[2] = buffer[1];
                        iPtr[3] = buffer[0];
                        cout << "i = " <<hex<< i << endl;
                }
        }


}
```

```java
import java.io.BufferedInputStream;
import java.io.DataInputStream;
import java.io.File;
import java.io.FileInputStream;
import java.io.FileNotFoundException;
import java.io.IOException;

class EX_readBinaryFile
{
    public static void main(String[] args) throws IOException, FileNotFoundException
    {
        File file = new File("test1.bin");
        byte[] fileData = new byte[(int) file.length()];
        DataInputStream dis = new DataInputStream(new FileInputStream(file));
        dis.readFully(fileData);
        dis.close();

        for( int i = 0; i < fileData.length; i+=4 )
        {
            int x = 0;
            x = x | ((fileData[i] & 0x000000FF)<<24);
            x = x | ((fileData[i+1] & 0x000000FF) << 16);
            x = x | ((fileData[i+2] & 0x000000FF) << 8);
            x = x | (fileData[i+3] & 0x000000FF);
            System.out.println(x);
            System.out.println((x>>26) & 0x0000003F);
            System.out.println(((x<<6)>>27) & 0x0000001F);
            System.out.println( Integer.toHexString(x) );

        }

    }

}
```

```
import sys
import os
import struct

# convert ints to signed
def imm16BitUnsignedTo32BitSignedConverter( num ):
        negBitMask = 0x00008000
        # if the 16th bit is 1, the 16 bit value is negative
        if( negBitMask & num ) > 0 :
                # put 1s in the upper 16 bits
                num = num | 0xFFFF0000
                # now perform a 2's complement conversion
                # flip the bits using XOR
                num = num ^ 0xFFFFFFFF
                # add 1
                num = num + 1
                # num is now the positive version of the number
                # multiply by -1 to get a signed integer with the negative number
                num = num * -1
        return num

# how to read binary file and get ints
inFile = open( sys.argv[1], 'rb' )

# get the file length
inFileLen = os.stat( sys.argv[1] )[6]
inFileWords = inFileLen / 4

instructions = []
address = []
# read the words from the file
for i in range( inFileWords ) :
        instructions.append( struct.unpack('>I', inFile.read(4))[0] )
        address.append( 96 + (i*4) )

        # use I to hold the current instruction
        I = instructions[ len(instructions)-1 ]
        # get IMMEDIATE bits
        IMM = ((I << 16) & 0xFFFFFFFF ) >> 16
        IMM = imm16BitUnsignedTo32BitSignedConverter( IMM )
        print bin(I)
        print IMM
        # get the opcode bits
        OP = I>>26
        print OP
        # get the RS bits
        RS = ((I<<6) & 0xFFFFFFFF) >> 27
        print RS
        print '----'

inFile.close()
```

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```c
/*******************************************************
This program converts a binary file to a file
containing string representations of the 1's and 0's
in the binfary file.
*******************************************************/

// gcc -o b2t b2t.c
// Usage ./a.out < inputfile > outputfile

#include<stdio.h>

main( int argc, char** argv)
{

    if ( argc >1 )
        fprintf(stderr,"Usage: ./a.out < input_txt > output_bin\n");
    char word[32];
    unsigned char vals[4];
    unsigned char w, div, b;
    unsigned char tot ;

    w = 0;
    while( scanf( "%c", &tot) != EOF )
    {
            div = 128;
            for( b=0; b<8; b++ )
            {
                if( tot >= div)
                {
                    printf( "1" );
                    tot -= div;
                }
                else
                    printf( "0");
                div = div/2;
             }
            w ++;
            if ( w == 4 )
            {
                printf("\n");
                w = 0;
            }

    }

}
```

```c
/******************************************************
This program converts a text file containing text
strings of 1's and 0's to a binary file.

for example, the text string:
000000010000000011111111110101010
would result in the following binary sequence
(written as hex here) in the output file:
0100FFAA
 *****************************************************/

// gcc -o t2b t2b.c
// Usage ./a.out < inputfile > outputfile

#include<stdio.h>

main( int argc , char **argv )
{

    if( argc > 1 )
    fprintf(stderr,"Usage: ./a.out < input_txt > output_bin\n");
    char word[32];
    unsigned char vals[4];
    int w, mul, b;
    unsigned char tot ;

    while( scanf(" %s", word ) > 0 )
    {
        for( w=0; w<4; w++ )
        {
            mul = 128;
            tot = 0;
            for( b=0; b<8; b++ )
            {
                tot += (word[w*8+b]=='1')*mul;
                mul = mul/2;
            }
            fputc( tot, stdout);
        }
    }

}
```

```
00100000000000010000000000001010
10100000000000010000000000001010
10101100000000010000000100001000
00001010000000000000000000000000
10001100000000010000000100001000
10000100001000000000000000001100
10000000000000010101000010000000
10001101010001100000000010101100
10001101010001000000000011011000
10001100000001010000000100000100
10000100011000000000000000000010
10000000100001010011000000100010
10001000000000000000000000100110
10000000100001010011000000100000
10101101010001100000000010101100
10100000001000011111111111111111
10101100000000010000000100001000
10001000000000000000000000011100
10000000000000000000000000001101
11111111111111111111111111111111
11111111111111111111111111111110
11111111111111111111111111111101
00000000000000000000000000000001
00000000000000000000000000000010
00000000000000000000000000000011
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000101
11111111111111111111111111111011
00000000000000000000000000000110
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000000
00000000000000000000000000000001
00000000000000000000000000000000
```

```
int A[11] = {-1, -2, -3, 1, 2, 3, 0, 0, 5, -5, 6};
int B[11] = { 0,  0,  0, 0, 0, 0, 0, 0, 0,  0, 0};
int C = 1;

main()
{
    int i;

    for (i=10; i>=0; i--) {
        if (A[i] >= 0)
            A[i] = B[i] - C;
        else
            A[i] = B[i] + C;
    }
}
```

```
0 01000 00000 00001 00000 00000 001010   96        Invalid Instruction
1 01000 00000 00001 00000 00000 001010   100       ADDI    R1, R0, #10
1 01011 00000 00001 00000 00100 001000   104       SW      R1, 264(R0)
0 00010 10000 00000 00000 00000 000000   108       Invalid Instruction
1 00011 00000 00001 00000 00100 001000   112       LW      R1, 264(R0)
1 00001 00001 00000 00000 00000 001100   116       BLTZ    R1, #48
1 00000 00000 00001 01010 00010 000000   120       SLL     R10, R1, #2
1 00011 01010 00011 00010 101100         124       LW      R3, 172(R10)
1 00011 01010 00100 00000 00011 011000   128       LW      R4, 216(R10)
1 00011 00000 00101 00000 00100 000100   132       LW      R5, 260(R0)
1 00001 00011 00000 00000 00000 000010   136       BLTZ    R3, #8
1 00000 00100 00101 00110 00000 100010   140       SUB     R6, R4, R5
1 00010 00000 00000 00000 00000 100110   144       J       #152
1 00000 00100 00101 00110 00000 100000   148       ADD     R6, R4, R5
1 01011 01010 00110 00000 00010 101100   152       SW      R6, 172(R10)
1 01000 00001 00001 11111 11111 111111   156       ADDI    R1, R1, #-1
1 01011 00000 00001 00000 00100 001000   160       SW      R1, 264(R0)
1 00010 00000 00000 00000 00000 011100   164       J       #112
1 00000 00000 00000 00000 00000 001101   168       BREAK
11111111111111111111111111111111         172       -1
11111111111111111111111111111110         176       -2
11111111111111111111111111111101         180       -3
00000000000000000000000000000001         184       1
00000000000000000000000000000010         188       2
00000000000000000000000000000011         192       3
00000000000000000000000000000000         196       0
00000000000000000000000000000000         200       0
00000000000000000000000000000101         204       5
11111111111111111111111111111011         208       -5
00000000000000000000000000000110         212       6
00000000000000000000000000000000         216       0
00000000000000000000000000000000         220       0
00000000000000000000000000000000         224       0
00000000000000000000000000000000         228       0
00000000000000000000000000000000         232       0
00000000000000000000000000000000         236       0
00000000000000000000000000000000         240       0
00000000000000000000000000000000         244       0
00000000000000000000000000000000         248       0
00000000000000000000000000000000         252       0
00000000000000000000000000000000         256       0
00000000000000000000000000000001         260       1
00000000000000000000000000000000         264       0
```

```
        ; Initially PC is set to 100
        ; Data section is right after the code section

        .text 100
        .global _main

_main:
        ADDI    R1, R0, #10     ; init i
        SW      R1, VAR_i(R0)   ; store i
FOR_0:
        LW      R1, VAR_i(R0)
        BLTZ    R1, END_FOR_0   ; i >= 0?
        SLL     R10, R1, #2     ; get correct word boundary
        LW      R3, A(R10)      ; read A[i]
        LW      R4, B(R10)      ; read B[i]
        LW      R5, C(R0)       ; read C
        BLTZ    R3, ELSE_0      ; A[i] >= 0 ?
        SUB     R6, R4, R5      ; B[i] - C
        J       TAIL_0

ELSE_0:
        ADD     R6, R4, R5      ; B[i] + C

TAIL_0:
        SW      R6, A(R10)      ; rewrite A[i]
        ADDI    R1, R1, #-1     ; i--
        SW      R1, VAR_i(R0)
        J       FOR_0

END_FOR_0:
        BREAK

A:
        .word   -1, -2, -3, 1, 2, 3, 0, 0, 5, -5, 6
B:
        .word   0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
C:
; let C be 1
        .word   1
VAR_i:
; for var i
        .word   0
```

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```
===================
cycle:1 100      ADDI    R1, R0, #10

registers:
r00:    0        10       0       0       0       0       0       0
r08:    0        0        0       0       0       0       0       0
r16:    0        0        0       0       0       0       0       0
r24:    0        0        0       0       0       0       0       0

data:
172:    -1       -2       -3      1       2       3       0       0
204:    5        -5       6       0       0       0       0       0
236:    0        0        0       0       0       0       1       0

===================
cycle:2 104      SW      R1, 264(R0)

registers:
r00:    0        10       0       0       0       0       0       0
r08:    0        0        0       0       0       0       0       0
r16:    0        0        0       0       0       0       0       0
r24:    0        0        0       0       0       0       0       0

data:
172:    -1       -2       -3      1       2       3       0       0
204:    5        -5       6       0       0       0       0       0
236:    0        0        0       0       0       0       1       10

===================
cycle:3 112      LW      R1, 264(R0)

registers:
r00:    0        10       0       0       0       0       0       0
r08:    0        0        0       0       0       0       0       0
r16:    0        0        0       0       0       0       0       0
r24:    0        0        0       0       0       0       0       0

data:
172:    -1       -2       -3      1       2       3       0       0
204:    5        -5       6       0       0       0       0       0
236:    0        0        0       0       0       0       1       10

===================
cycle:4 116      BLTZ    R1, #48

registers:
r00:    0        10       0       0       0       0       0       0
r08:    0        0        0       0       0       0       0       0
r16:    0        0        0       0       0       0       0       0
r24:    0        0        0       0       0       0       0       0

data:
172:    -1       -2       -3      1       2       3       0       0
204:    5        -5       6       0       0       0       0       0
236:    0        0        0       0       0       0       1       10

===================
cycle:5 120      SLL     R10, R1, #2

registers:
r00:    0        10       0       0       0       0       0       0
r08:    0        0        40      0       0       0       0       0
r16:    0        0        0       0       0       0       0       0
r24:    0        0        0       0       0       0       0       0
```

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```
data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      6       0       0       0       0       0
236:    0       0       0       0       0       0       1       10


===================
cycle:6 124     LW      R3, 172(R10)

registers:
r00:    0       10      0       6       0       0       0       0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      6       0       0       0       0       0
236:    0       0       0       0       0       0       1       10


===================
cycle:7 128     LW      R4, 216(R10)

registers:
r00:    0       10      0       6       0       0       0       0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      6       0       0       0       0       0
236:    0       0       0       0       0       0       1       10


===================
cycle:8 132     LW      R5, 260(R0)

registers:
r00:    0       10      0       6       0       1       0       0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      6       0       0       0       0       0
236:    0       0       0       0       0       0       1       10


===================
cycle:9 136     BLTZ    R3, #8

registers:
r00:    0       10      0       6       0       1       0       0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      6       0       0       0       0       0
236:    0       0       0       0       0       0       1       10


===================
cycle:10        140     SUB     R6, R4, R5

registers:
```

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```
r00:     0      10      0       6       0       1      -1       0
r08:     0       0      40       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:     5      -5       6       0       0       0       0       0
236:     0       0       0       0       0       0       1      10

===================
cycle:11        144     J       #152

registers:
r00:     0      10      0       6       0       1      -1       0
r08:     0       0      40       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:     5      -5       6       0       0       0       0       0
236:     0       0       0       0       0       0       1      10

===================
cycle:12        152     SW      R6, 172(R10)

registers:
r00:     0      10      0       6       0       1      -1       0
r08:     0       0      40       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:     5      -5      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1      10

===================
cycle:13        156     ADDI    R1, R1, #-1

registers:
r00:     0       9      0       6       0       1      -1       0
r08:     0       0      40       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:     5      -5      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1      10

===================
cycle:14        160     SW      R1, 264(R0)

registers:
r00:     0       9      0       6       0       1      -1       0
r08:     0       0      40       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:     5      -5      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       9
```

17

```
====================
cycle:15       164      J       #112

registers:
r00:    0       9       0       6       0       1       -1      0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       9

====================
cycle:16       112      LW      R1, 264(R0)

registers:
r00:    0       9       0       6       0       1       -1      0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       9

====================
cycle:17       116      BLTZ    R1, #48

registers:
r00:    0       9       0       6       0       1       -1      0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       9

====================
cycle:18       120      SLL     R10, R1, #2

registers:
r00:    0       9       0       6       0       1       -1      0
r08:    0       0       36      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       9

====================
cycle:19       124      LW      R3, 172(R10)

registers:
r00:    0       9       0       -5      0       1       -1      0
r08:    0       0       36      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0
```

18

```
data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       9

===================
cycle:20        128     LW      R4, 216(R10)

registers:
r00:    0       9       0       -5      0       1       -1      0
r08:    0       0       36      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       9

===================
cycle:21        132     LW      R5, 260(R0)

registers:
r00:    0       9       0       -5      0       1       -1      0
r08:    0       0       36      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       9

===================
cycle:22        136     BLTZ    R3, #8

registers:
r00:    0       9       0       -5      0       1       -1      0
r08:    0       0       36      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       9

===================
cycle:23        148     ADD     R6, R4, R5

registers:
r00:    0       9       0       -5      0       1       1       0
r08:    0       0       36      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    5       -5      -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       9

===================
cycle:24        152     SW      R6, 172(R10)
```

19

```
registers:
r00:    0        9        0       -5        0        1        1        0
r08:    0        0       36        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2       -3        1        2        3        0        0
204:    5        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        9

===================
cycle:25         156      ADDI     R1, R1, #-1

registers:
r00:    0        8        0       -5        0        1        1        0
r08:    0        0       36        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2       -3        1        2        3        0        0
204:    5        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        9

===================
cycle:26         160      SW       R1, 264(R0)

registers:
r00:    0        8        0       -5        0        1        1        0
r08:    0        0       36        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2       -3        1        2        3        0        0
204:    5        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        8

===================
cycle:27         164      J        #112

registers:
r00:    0        8        0       -5        0        1        1        0
r08:    0        0       36        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2       -3        1        2        3        0        0
204:    5        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        8

===================
cycle:28         112      LW       R1, 264(R0)

registers:
r00:    0        8        0       -5        0        1        1        0
r08:    0        0       36        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2       -3        1        2        3        0        0
204:    5        1       -1        0        0        0        0        0
```

20

```
236:    0        0        0        0        0        0        1        8


===================
cycle:29         116       BLTZ    R1, #48

registers:
r00:    0        8        0       -5        0        1        1        0
r08:    0        0        36       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2       -3        1        2        3        0        0
204:    5        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        8


===================
cycle:30         120       SLL     R10, R1, #2

registers:
r00:    0        8        0       -5        0        1        1        0
r08:    0        0        32       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2       -3        1        2        3        0        0
204:    5        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        8


===================
cycle:31         124       LW      R3, 172(R10)

registers:
r00:    0        8        0        5        0        1        1        0
r08:    0        0        32       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2       -3        1        2        3        0        0
204:    5        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        8


===================
cycle:32         128       LW      R4, 216(R10)

registers:
r00:    0        8        0        5        0        1        1        0
r08:    0        0        32       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2       -3        1        2        3        0        0
204:    5        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        8


===================
cycle:33         132       LW      R5, 260(R0)

registers:
r00:    0        8        0        5        0        1        1        0
r08:    0        0        32       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
```

21

```
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:     5       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       8

===================
cycle:34        136     BLTZ    R3, #8

registers:
r00:     0       8       0       5       0       1       1       0
r08:     0       0      32       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:     5       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       8

===================
cycle:35        140     SUB     R6, R4, R5

registers:
r00:     0       8       0       5       0       1      -1       0
r08:     0       0      32       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:     5       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       8

===================
cycle:36        144     J       #152

registers:
r00:     0       8       0       5       0       1      -1       0
r08:     0       0      32       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:     5       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       8

===================
cycle:37        152     SW      R6, 172(R10)

registers:
r00:     0       8       0       5       0       1      -1       0
r08:     0       0      32       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       8

===================
cycle:38        156     ADDI    R1, R1, #-1
```

22

```
registers:
r00:    0       7       0       5       0       1       -1      0
r08:    0       0       32      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       8

===================
cycle:39        160     SW      R1, 264(R0)

registers:
r00:    0       7       0       5       0       1       -1      0
r08:    0       0       32      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       7

===================
cycle:40        164     J       #112

registers:
r00:    0       7       0       5       0       1       -1      0
r08:    0       0       32      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       7

===================
cycle:41        112     LW      R1, 264(R0)

registers:
r00:    0       7       0       5       0       1       -1      0
r08:    0       0       32      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       7

===================
cycle:42        116     BLTZ    R1, #48

registers:
r00:    0       7       0       5       0       1       -1      0
r08:    0       0       32      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       0
```

23

```
204:    -1      1      -1      0      0      0      0      0
236:     0      0       0      0      0      0      1      7


===================
cycle:43        120     SLL     R10, R1, #2

registers:
r00:     0      7       0      5      0      1     -1      0
r08:     0      0      28      0      0      0      0      0
r16:     0      0       0      0      0      0      0      0
r24:     0      0       0      0      0      0      0      0

data:
172:    -1     -2      -3      1      2      3      0      0
204:    -1      1      -1      0      0      0      0      0
236:     0      0       0      0      0      0      1      7


===================
cycle:44        124     LW      R3, 172(R10)

registers:
r00:     0      7       0      0      0      1     -1      0
r08:     0      0      28      0      0      0      0      0
r16:     0      0       0      0      0      0      0      0
r24:     0      0       0      0      0      0      0      0

data:
172:    -1     -2      -3      1      2      3      0      0
204:    -1      1      -1      0      0      0      0      0
236:     0      0       0      0      0      0      1      7


===================
cycle:45        128     LW      R4, 216(R10)

registers:
r00:     0      7       0      0      0      1     -1      0
r08:     0      0      28      0      0      0      0      0
r16:     0      0       0      0      0      0      0      0
r24:     0      0       0      0      0      0      0      0

data:
172:    -1     -2      -3      1      2      3      0      0
204:    -1      1      -1      0      0      0      0      0
236:     0      0       0      0      0      0      1      7


===================
cycle:46        132     LW      R5, 260(R0)

registers:
r00:     0      7       0      0      0      1     -1      0
r08:     0      0      28      0      0      0      0      0
r16:     0      0       0      0      0      0      0      0
r24:     0      0       0      0      0      0      0      0

data:
172:    -1     -2      -3      1      2      3      0      0
204:    -1      1      -1      0      0      0      0      0
236:     0      0       0      0      0      0      1      7


===================
cycle:47        136     BLTZ    R3, #8

registers:
r00:     0      7       0      0      0      1     -1      0
r08:     0      0      28      0      0      0      0      0
```

24

```
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       7

===================
cycle:48       140     SUB     R6, R4, R5

registers:
r00:     0       7       0       0       0       1      -1       0
r08:     0       0      28       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       7

===================
cycle:49       144     J       #152

registers:
r00:     0       7       0       0       0       1      -1       0
r08:     0       0      28       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0       0
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       7

===================
cycle:50       152     SW      R6, 172(R10)

registers:
r00:     0       7       0       0       0       1      -1       0
r08:     0       0      28       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0      -1
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       7

===================
cycle:51       156     ADDI    R1, R1, #-1

registers:
r00:     0       6       0       0       0       1      -1       0
r08:     0       0      28       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3       1       2       3       0      -1
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       7

===================
```

```
cycle:52         160      SW       R1, 264(R0)

registers:
r00:    0        6        0        0        0        1        -1       0
r08:    0        0        28       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    -1       -2       -3       1        2        3        0        -1
204:    -1       1        -1       0        0        0        0        0
236:    0        0        0        0        0        0        1        6

===================
cycle:53         164      J        #112

registers:
r00:    0        6        0        0        0        1        -1       0
r08:    0        0        28       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    -1       -2       -3       1        2        3        0        -1
204:    -1       1        -1       0        0        0        0        0
236:    0        0        0        0        0        0        1        6

===================
cycle:54         112      LW       R1, 264(R0)

registers:
r00:    0        6        0        0        0        1        -1       0
r08:    0        0        28       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    -1       -2       -3       1        2        3        0        -1
204:    -1       1        -1       0        0        0        0        0
236:    0        0        0        0        0        0        1        6

===================
cycle:55         116      BLTZ     R1, #48

registers:
r00:    0        6        0        0        0        1        -1       0
r08:    0        0        28       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    -1       -2       -3       1        2        3        0        -1
204:    -1       1        -1       0        0        0        0        0
236:    0        0        0        0        0        0        1        6

===================
cycle:56         120      SLL      R10, R1, #2

registers:
r00:    0        6        0        0        0        1        -1       0
r08:    0        0        24       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
```

26

```
172:     -1      -2      -3      1       2       3       0       -1
204:     -1      1       -1      0       0       0       0       0
236:     0       0       0       0       0       0       1       6

===================
cycle:57        124     LW      R3, 172(R10)

registers:
r00:     0       6       0       0       0       1       -1      0
r08:     0       0       24      0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     -1      -2      -3      1       2       3       0       -1
204:     -1      1       -1      0       0       0       0       0
236:     0       0       0       0       0       0       1       6

===================
cycle:58        128     LW      R4, 216(R10)

registers:
r00:     0       6       0       0       0       1       -1      0
r08:     0       0       24      0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     -1      -2      -3      1       2       3       0       -1
204:     -1      1       -1      0       0       0       0       0
236:     0       0       0       0       0       0       1       6

===================
cycle:59        132     LW      R5, 260(R0)

registers:
r00:     0       6       0       0       0       1       -1      0
r08:     0       0       24      0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     -1      -2      -3      1       2       3       0       -1
204:     -1      1       -1      0       0       0       0       0
236:     0       0       0       0       0       0       1       6

===================
cycle:60        136     BLTZ    R3, #8

registers:
r00:     0       6       0       0       0       1       -1      0
r08:     0       0       24      0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     -1      -2      -3      1       2       3       0       -1
204:     -1      1       -1      0       0       0       0       0
236:     0       0       0       0       0       0       1       6

===================
cycle:61        140     SUB     R6, R4, R5

registers:
r00:     0       6       0       0       0       1       -1      0
```

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```
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       6

===================
cycle:62        144     J       #152

registers:
r00:    0       6       0       0       0       1       -1      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       0       -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       6

===================
cycle:63        152     SW      R6, 172(R10)

registers:
r00:    0       6       0       0       0       1       -1      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       6

===================
cycle:64        156     ADDI    R1, R1, #-1

registers:
r00:    0       5       0       0       0       1       -1      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       6

===================
cycle:65        160     SW      R1, 264(R0)

registers:
r00:    0       5       0       0       0       1       -1      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       5
```

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```
===================
cycle:66        164     J       #112

registers:
r00:    0       5       0       0       0       1       -1      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       5

===================
cycle:67        112     LW      R1, 264(R0)

registers:
r00:    0       5       0       0       0       1       -1      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       5

===================
cycle:68        116     BLTZ    R1, #48

registers:
r00:    0       5       0       0       0       1       -1      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       5

===================
cycle:69        120     SLL     R10, R1, #2

registers:
r00:    0       5       0       0       0       1       -1      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       5

===================
cycle:70        124     LW      R3, 172(R10)

registers:
r00:    0       5       0       3       0       1       -1      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0
```

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```
data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       5


===================
cycle:71        128     LW      R4, 216(R10)

registers:
r00:    0       5       0       3       0       1       -1      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       5


===================
cycle:72        132     LW      R5, 260(R0)

registers:
r00:    0       5       0       3       0       1       -1      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       5


===================
cycle:73        136     BLTZ    R3, #8

registers:
r00:    0       5       0       3       0       1       -1      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       5


===================
cycle:74        140     SUB     R6, R4, R5

registers:
r00:    0       5       0       3       0       1       -1      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       3       -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       5


===================
cycle:75        144     J       #152

registers:
```

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```
r00:    0       5       0       3       0       1      -1       0
r08:    0       0      20       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:   -1      -2      -3       1       2       3      -1      -1
204:   -1       1      -1       0       0       0       0       0
236:    0       0       0       0       0       0       1       5

===================
cycle:76        152     SW      R6, 172(R10)

registers:
r00:    0       5       0       3       0       1      -1       0
r08:    0       0      20       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:   -1      -2      -3       1       2      -1      -1      -1
204:   -1       1      -1       0       0       0       0       0
236:    0       0       0       0       0       0       1       5

===================
cycle:77        156     ADDI    R1, R1, #-1

registers:
r00:    0       4       0       3       0       1      -1       0
r08:    0       0      20       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:   -1      -2      -3       1       2      -1      -1      -1
204:   -1       1      -1       0       0       0       0       0
236:    0       0       0       0       0       0       1       5

===================
cycle:78        160     SW      R1, 264(R0)

registers:
r00:    0       4       0       3       0       1      -1       0
r08:    0       0      20       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:   -1      -2      -3       1       2      -1      -1      -1
204:   -1       1      -1       0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:79        164     J       #112

registers:
r00:    0       4       0       3       0       1      -1       0
r08:    0       0      20       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:   -1      -2      -3       1       2      -1      -1      -1
204:   -1       1      -1       0       0       0       0       0
236:    0       0       0       0       0       0       1       4
```

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```
===================
cycle:80          112       LW       R1, 264(R0)

registers:
r00:    0       4       0       3       0       1       -1      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:81          116       BLTZ     R1, #48

registers:
r00:    0       4       0       3       0       1       -1      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:82          120       SLL      R10, R1, #2

registers:
r00:    0       4       0       3       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:83          124       LW       R3, 172(R10)

registers:
r00:    0       4       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:84          128       LW       R4, 216(R10)

registers:
r00:    0       4       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0
```

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```
data:
172:    -1      -2      -3      1       2       -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:85        132     LW      R5, 260(R0)

registers:
r00:    0       4       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:86        136     BLTZ    R3, #8

registers:
r00:    0       4       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:87        140     SUB     R6, R4, R5

registers:
r00:    0       4       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:88        144     J       #152

registers:
r00:    0       4       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       2       -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:89        152     SW      R6, 172(R10)
```

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```
registers:
r00:    0       4       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       -1      -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:90        156     ADDI    R1, R1, #-1

registers:
r00:    0       3       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       -1      -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       4

===================
cycle:91        160     SW      R1, 264(R0)

registers:
r00:    0       3       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       -1      -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       3

===================
cycle:92        164     J       #112

registers:
r00:    0       3       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       -1      -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       3

===================
cycle:93        112     LW      R1, 264(R0)

registers:
r00:    0       3       0       2       0       1       -1      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      1       -1      -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
```

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```
236:      0        0        0        0        0        0        1        3


===================
cycle:94        116      BLTZ    R1, #48

registers:
r00:      0        3        0        2        0        1       -1        0
r08:      0        0       16        0        0        0        0        0
r16:      0        0        0        0        0        0        0        0
r24:      0        0        0        0        0        0        0        0

data:
172:     -1       -2       -3        1       -1       -1       -1       -1
204:     -1        1       -1        0        0        0        0        0
236:      0        0        0        0        0        0        1        3


===================
cycle:95        120      SLL     R10, R1, #2

registers:
r00:      0        3        0        2        0        1       -1        0
r08:      0        0       12        0        0        0        0        0
r16:      0        0        0        0        0        0        0        0
r24:      0        0        0        0        0        0        0        0

data:
172:     -1       -2       -3        1       -1       -1       -1       -1
204:     -1        1       -1        0        0        0        0        0
236:      0        0        0        0        0        0        1        3


===================
cycle:96        124      LW      R3, 172(R10)

registers:
r00:      0        3        0        1        0        1       -1        0
r08:      0        0       12        0        0        0        0        0
r16:      0        0        0        0        0        0        0        0
r24:      0        0        0        0        0        0        0        0

data:
172:     -1       -2       -3        1       -1       -1       -1       -1
204:     -1        1       -1        0        0        0        0        0
236:      0        0        0        0        0        0        1        3


===================
cycle:97        128      LW      R4, 216(R10)

registers:
r00:      0        3        0        1        0        1       -1        0
r08:      0        0       12        0        0        0        0        0
r16:      0        0        0        0        0        0        0        0
r24:      0        0        0        0        0        0        0        0

data:
172:     -1       -2       -3        1       -1       -1       -1       -1
204:     -1        1       -1        0        0        0        0        0
236:      0        0        0        0        0        0        1        3


===================
cycle:98        132      LW      R5, 260(R0)

registers:
r00:      0        3        0        1        0        1       -1        0
r08:      0        0       12        0        0        0        0        0
r16:      0        0        0        0        0        0        0        0
```

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```
r24:    0        0        0        0        0        0        0        0

data:
172:    -1       -2       -3       1        -1       -1       -1       -1
204:    -1       1        -1       0        0        0        0        0
236:    0        0        0        0        0        0        1        3

===================
cycle:99        136       BLTZ     R3, #8

registers:
r00:    0        3        0        1        0        1        -1       0
r08:    0        0        12       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    -1       -2       -3       1        -1       -1       -1       -1
204:    -1       1        -1       0        0        0        0        0
236:    0        0        0        0        0        0        1        3

===================
cycle:100       140       SUB      R6, R4, R5

registers:
r00:    0        3        0        1        0        1        -1       0
r08:    0        0        12       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    -1       -2       -3       1        -1       -1       -1       -1
204:    -1       1        -1       0        0        0        0        0
236:    0        0        0        0        0        0        1        3

===================
cycle:101       144       J        #152

registers:
r00:    0        3        0        1        0        1        -1       0
r08:    0        0        12       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    -1       -2       -3       1        -1       -1       -1       -1
204:    -1       1        -1       0        0        0        0        0
236:    0        0        0        0        0        0        1        3

===================
cycle:102       152       SW       R6, 172(R10)

registers:
r00:    0        3        0        1        0        1        -1       0
r08:    0        0        12       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    -1       -2       -3       -1       -1       -1       -1       -1
204:    -1       1        -1       0        0        0        0        0
236:    0        0        0        0        0        0        1        3

===================
cycle:103       156       ADDI     R1, R1, #-1
```

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```
registers:
r00:    0       2       0       1       0       1       -1      0
r08:    0       0       12      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      -1      -1      -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       3

===================
cycle:104       160     SW      R1, 264(R0)

registers:
r00:    0       2       0       1       0       1       -1      0
r08:    0       0       12      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      -1      -1      -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       2

===================
cycle:105       164     J       #112

registers:
r00:    0       2       0       1       0       1       -1      0
r08:    0       0       12      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      -1      -1      -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       2

===================
cycle:106       112     LW      R1, 264(R0)

registers:
r00:    0       2       0       1       0       1       -1      0
r08:    0       0       12      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      -1      -1      -1      -1      -1
204:    -1      1       -1      0       0       0       0       0
236:    0       0       0       0       0       0       1       2

===================
cycle:107       116     BLTZ    R1, #48

registers:
r00:    0       2       0       1       0       1       -1      0
r08:    0       0       12      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    -1      -2      -3      -1      -1      -1      -1      -1
```

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```
204:     -1       1       -1       0       0       0       0       0
236:      0       0       0       0       0       0       1       2

====================
cycle:108     120     SLL     R10, R1, #2

registers:
r00:      0       2       0       1       0       1      -1       0
r08:      0       0       8       0       0       0       0       0
r16:      0       0       0       0       0       0       0       0
r24:      0       0       0       0       0       0       0       0

data:
172:     -1      -2      -3      -1      -1      -1      -1      -1
204:     -1       1      -1       0       0       0       0       0
236:      0       0       0       0       0       0       1       2

====================
cycle:109     124     LW      R3, 172(R10)

registers:
r00:      0       2       0      -3       0       1      -1       0
r08:      0       0       8       0       0       0       0       0
r16:      0       0       0       0       0       0       0       0
r24:      0       0       0       0       0       0       0       0

data:
172:     -1      -2      -3      -1      -1      -1      -1      -1
204:     -1       1      -1       0       0       0       0       0
236:      0       0       0       0       0       0       1       2

====================
cycle:110     128     LW      R4, 216(R10)

registers:
r00:      0       2       0      -3       0       1      -1       0
r08:      0       0       8       0       0       0       0       0
r16:      0       0       0       0       0       0       0       0
r24:      0       0       0       0       0       0       0       0

data:
172:     -1      -2      -3      -1      -1      -1      -1      -1
204:     -1       1      -1       0       0       0       0       0
236:      0       0       0       0       0       0       1       2

====================
cycle:111     132     LW      R5, 260(R0)

registers:
r00:      0       2       0      -3       0       1      -1       0
r08:      0       0       8       0       0       0       0       0
r16:      0       0       0       0       0       0       0       0
r24:      0       0       0       0       0       0       0       0

data:
172:     -1      -2      -3      -1      -1      -1      -1      -1
204:     -1       1      -1       0       0       0       0       0
236:      0       0       0       0       0       0       1       2

====================
cycle:112     136     BLTZ    R3, #8

registers:
r00:      0       2       0      -3       0       1      -1       0
r08:      0       0       8       0       0       0       0       0
```

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```
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:   -1      -2      -3      -1      -1      -1      -1      -1
204:   -1       1      -1       0       0       0       0       0
236:    0       0       0       0       0       0       1       2

==================
cycle:113       148     ADD     R6, R4, R5

registers:
r00:    0       2       0      -3       0       1       1       0
r08:    0       0       8       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:   -1      -2      -3      -1      -1      -1      -1      -1
204:   -1       1      -1       0       0       0       0       0
236:    0       0       0       0       0       0       1       2

==================
cycle:114       152     SW      R6, 172(R10)

registers:
r00:    0       2       0      -3       0       1       1       0
r08:    0       0       8       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:   -1      -2       1      -1      -1      -1      -1      -1
204:   -1       1      -1       0       0       0       0       0
236:    0       0       0       0       0       0       1       2

==================
cycle:115       156     ADDI    R1, R1, #-1

registers:
r00:    0       1       0      -3       0       1       1       0
r08:    0       0       8       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:   -1      -2       1      -1      -1      -1      -1      -1
204:   -1       1      -1       0       0       0       0       0
236:    0       0       0       0       0       0       1       2

==================
cycle:116       160     SW      R1, 264(R0)

registers:
r00:    0       1       0      -3       0       1       1       0
r08:    0       0       8       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:   -1      -2       1      -1      -1      -1      -1      -1
204:   -1       1      -1       0       0       0       0       0
236:    0       0       0       0       0       0       1       1

==================
```

39

```
cycle:117        164      J        #112

registers:
r00:    0        1        0       -3        0        1        1        0
r08:    0        0        8        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2        1       -1       -1       -1       -1       -1
204:   -1        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        1

===================
cycle:118        112      LW       R1, 264(R0)

registers:
r00:    0        1        0       -3        0        1        1        0
r08:    0        0        8        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2        1       -1       -1       -1       -1       -1
204:   -1        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        1

===================
cycle:119        116      BLTZ     R1, #48

registers:
r00:    0        1        0       -3        0        1        1        0
r08:    0        0        8        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2        1       -1       -1       -1       -1       -1
204:   -1        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        1

===================
cycle:120        120      SLL      R10, R1, #2

registers:
r00:    0        1        0       -3        0        1        1        0
r08:    0        0        4        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1       -2        1       -1       -1       -1       -1       -1
204:   -1        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        1

===================
cycle:121        124      LW       R3, 172(R10)

registers:
r00:    0        1        0       -2        0        1        1        0
r08:    0        0        4        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
```

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```
172:    -1      -2       1      -1      -1      -1      -1      -1
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       1

===================
cycle:122      128     LW      R4, 216(R10)

registers:
r00:     0       1       0      -2       0       1       1       0
r08:     0       0       4       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2       1      -1      -1      -1      -1      -1
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       1

===================
cycle:123      132     LW      R5, 260(R0)

registers:
r00:     0       1       0      -2       0       1       1       0
r08:     0       0       4       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2       1      -1      -1      -1      -1      -1
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       1

===================
cycle:124      136     BLTZ    R3, #8

registers:
r00:     0       1       0      -2       0       1       1       0
r08:     0       0       4       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2       1      -1      -1      -1      -1      -1
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       1

===================
cycle:125      148     ADD     R6, R4, R5

registers:
r00:     0       1       0      -2       0       1       1       0
r08:     0       0       4       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:    -1      -2       1      -1      -1      -1      -1      -1
204:    -1       1      -1       0       0       0       0       0
236:     0       0       0       0       0       0       1       1

===================
cycle:126      152     SW      R6, 172(R10)

registers:
r00:     0       1       0      -2       0       1       1       0
```

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```
r08:    0        0        4        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1        1        1       -1       -1       -1       -1       -1
204:   -1        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        1

===================
cycle:127      156      ADDI    R1, R1, #-1

registers:
r00:    0        0        0       -2        0        1        1        0
r08:    0        0        4        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1        1        1       -1       -1       -1       -1       -1
204:   -1        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        1

===================
cycle:128      160      SW      R1, 264(R0)

registers:
r00:    0        0        0       -2        0        1        1        0
r08:    0        0        4        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1        1        1       -1       -1       -1       -1       -1
204:   -1        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        0

===================
cycle:129      164      J       #112

registers:
r00:    0        0        0       -2        0        1        1        0
r08:    0        0        4        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1        1        1       -1       -1       -1       -1       -1
204:   -1        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        0

===================
cycle:130      112      LW      R1, 264(R0)

registers:
r00:    0        0        0       -2        0        1        1        0
r08:    0        0        4        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:   -1        1        1       -1       -1       -1       -1       -1
204:   -1        1       -1        0        0        0        0        0
236:    0        0        0        0        0        0        1        0
```

```
===================
cycle:131        116     BLTZ    R1, #48

registers:
r00:    0        0        0       -2       0        1        1        0
r08:    0        0        4        0       0        0        0        0
r16:    0        0        0        0       0        0        0        0
r24:    0        0        0        0       0        0        0        0

data:
172:    -1       1        1       -1      -1       -1       -1       -1
204:    -1       1       -1        0       0        0        0        0
236:    0        0        0        0       0        0        1        0

===================
cycle:132        120     SLL     R10, R1, #2

registers:
r00:    0        0        0       -2       0        1        1        0
r08:    0        0        0        0       0        0        0        0
r16:    0        0        0        0       0        0        0        0
r24:    0        0        0        0       0        0        0        0

data:
172:    -1       1        1       -1      -1       -1       -1       -1
204:    -1       1       -1        0       0        0        0        0
236:    0        0        0        0       0        0        1        0

===================
cycle:133        124     LW      R3, 172(R10)

registers:
r00:    0        0        0       -1       0        1        1        0
r08:    0        0        0        0       0        0        0        0
r16:    0        0        0        0       0        0        0        0
r24:    0        0        0        0       0        0        0        0

data:
172:    -1       1        1       -1      -1       -1       -1       -1
204:    -1       1       -1        0       0        0        0        0
236:    0        0        0        0       0        0        1        0

===================
cycle:134        128     LW      R4, 216(R10)

registers:
r00:    0        0        0       -1       0        1        1        0
r08:    0        0        0        0       0        0        0        0
r16:    0        0        0        0       0        0        0        0
r24:    0        0        0        0       0        0        0        0

data:
172:    -1       1        1       -1      -1       -1       -1       -1
204:    -1       1       -1        0       0        0        0        0
236:    0        0        0        0       0        0        1        0

===================
cycle:135        132     LW      R5, 260(R0)

registers:
r00:    0        0        0       -1       0        1        1        0
r08:    0        0        0        0       0        0        0        0
r16:    0        0        0        0       0        0        0        0
r24:    0        0        0        0       0        0        0        0
```

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```
data:
172:     -1      1       1      -1      -1      -1      -1      -1
204:     -1      1      -1       0       0       0       0       0
236:      0      0       0       0       0       0       1       0


====================
cycle:136        136     BLTZ    R3, #8

registers:
r00:      0      0       0      -1       0       1       1       0
r08:      0      0       0       0       0       0       0       0
r16:      0      0       0       0       0       0       0       0
r24:      0      0       0       0       0       0       0       0

data:
172:     -1      1       1      -1      -1      -1      -1      -1
204:     -1      1      -1       0       0       0       0       0
236:      0      0       0       0       0       0       1       0


====================
cycle:137        148     ADD     R6, R4, R5

registers:
r00:      0      0       0      -1       0       1       1       0
r08:      0      0       0       0       0       0       0       0
r16:      0      0       0       0       0       0       0       0
r24:      0      0       0       0       0       0       0       0

data:
172:     -1      1       1      -1      -1      -1      -1      -1
204:     -1      1      -1       0       0       0       0       0
236:      0      0       0       0       0       0       1       0


====================
cycle:138        152     SW      R6, 172(R10)

registers:
r00:      0      0       0      -1       0       1       1       0
r08:      0      0       0       0       0       0       0       0
r16:      0      0       0       0       0       0       0       0
r24:      0      0       0       0       0       0       0       0

data:
172:      1      1       1      -1      -1      -1      -1      -1
204:     -1      1      -1       0       0       0       0       0
236:      0      0       0       0       0       0       1       0


====================
cycle:139        156     ADDI    R1, R1, #-1

registers:
r00:      0     -1       0      -1       0       1       1       0
r08:      0      0       0       0       0       0       0       0
r16:      0      0       0       0       0       0       0       0
r24:      0      0       0       0       0       0       0       0

data:
172:      1      1       1      -1      -1      -1      -1      -1
204:     -1      1      -1       0       0       0       0       0
236:      0      0       0       0       0       0       1       0


====================
cycle:140        160     SW      R1, 264(R0)

registers:
```

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```
r00:    0      -1      0      -1      0       1       1       0
r08:    0       0      0       0      0       0       0       0
r16:    0       0      0       0      0       0       0       0
r24:    0       0      0       0      0       0       0       0

data:
172:    1       1      1      -1     -1      -1      -1      -1
204:   -1       1     -1       0      0       0       0       0
236:    0       0      0       0      0       0       1      -1

===================
cycle:141     164     J      #112

registers:
r00:    0      -1      0      -1      0       1       1       0
r08:    0       0      0       0      0       0       0       0
r16:    0       0      0       0      0       0       0       0
r24:    0       0      0       0      0       0       0       0

data:
172:    1       1      1      -1     -1      -1      -1      -1
204:   -1       1     -1       0      0       0       0       0
236:    0       0      0       0      0       0       1      -1

===================
cycle:142     112     LW     R1, 264(R0)

registers:
r00:    0      -1      0      -1      0       1       1       0
r08:    0       0      0       0      0       0       0       0
r16:    0       0      0       0      0       0       0       0
r24:    0       0      0       0      0       0       0       0

data:
172:    1       1      1      -1     -1      -1      -1      -1
204:   -1       1     -1       0      0       0       0       0
236:    0       0      0       0      0       0       1      -1

===================
cycle:143     116     BLTZ   R1, #48

registers:
r00:    0      -1      0      -1      0       1       1       0
r08:    0       0      0       0      0       0       0       0
r16:    0       0      0       0      0       0       0       0
r24:    0       0      0       0      0       0       0       0

data:
172:    1       1      1      -1     -1      -1      -1      -1
204:   -1       1     -1       0      0       0       0       0
236:    0       0      0       0      0       0       1      -1

===================
cycle:144     168     BREAK

registers:
r00:    0      -1      0      -1      0       1       1       0
r08:    0       0      0       0      0       0       0       0
r16:    0       0      0       0      0       0       0       0
r24:    0       0      0       0      0       0       0       0

data:
172:    1       1      1      -1     -1      -1      -1      -1
204:   -1       1     -1       0      0       0       0       0
236:    0       0      0       0      0       0       1      -1
```

```
1 00010 00000 00000 00000 00000 011010   96     J       #104
0 01000 00000 00010 00000 00000 000010   100    Invalid Instruction
1 01000 00000 00001 00000 00001 100100   104    ADDI    R1, R0, #100
1 01000 00000 00010 00000 00000 011000   108    ADDI    R2, R0, #24
1 00000 00001 00010 00011 00000 100000   112    ADD     R3, R1, R2
1 00000 00011 00000 00000 00000 001000   116    JR      R3
0 01000 00000 10000 00000 00000 000001   120    Invalid Instruction
1 00000 00001 00010 00100 00000 100010   124    SUB     R4, R1, R2
1 00000 00000 00010 00101 00001 000000   128    SLL     R5, R2, #1
1 00000 00000 00101 00110 00001 000010   132    SRL     R6, R5, #1
1 11100 00010 00110 00111 00000 000010   136    MUL     R7, R2, R6
1 01000 00000 01000 00000 00000 000000   140    ADDI    R8, R0, #0
1 00000 00100 01000 01001 00000 001010   144    MOVZ    R9, R4, R8
1 00000 00000 00000 00000 00000 000000   148    NOP
1 00000 00000 00000 00000 00000 001101   152    BREAK
00000000000000000000000000000001         156    1
00000000000000000000000000000010         160    2
00000000000000000000000000000011         164    3
00000000000000000000000000000100         168    4
```

```
===================
cycle:1 96      J       #104

registers:
r00:    0       0       0       0       0       0       0       0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
156:    1       2       3       4

===================
cycle:2 104     ADDI    R1, R0, #100

registers:
r00:    0       100     0       0       0       0       0       0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
156:    1       2       3       4

===================
cycle:3 108     ADDI    R2, R0, #24

registers:
r00:    0       100     24      0       0       0       0       0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
156:    1       2       3       4

===================
cycle:4 112     ADD     R3, R1, R2

registers:
r00:    0       100     24      124     0       0       0       0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
156:    1       2       3       4

===================
cycle:5 116     JR      R3

registers:
r00:    0       100     24      124     0       0       0       0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
156:    1       2       3       4

===================
cycle:6 124     SUB     R4, R1, R2

registers:
r00:    0       100     24      124     76      0       0       0
```

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```
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
156:    1       2       3       4

===================
cycle:7 128     SLL     R5, R2, #1

registers:
r00:    0       100     24      124     76      48      0       0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
156:    1       2       3       4

===================
cycle:8 132     SRL     R6, R5, #1

registers:
r00:    0       100     24      124     76      48      24      0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
156:    1       2       3       4

===================
cycle:9 136     MUL     R7, R2, R6

registers:
r00:    0       100     24      124     76      48      24      576
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
156:    1       2       3       4

===================
cycle:10        140     ADDI    R8, R0, #0

registers:
r00:    0       100     24      124     76      48      24      576
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
156:    1       2       3       4

===================
cycle:11        144     MOVZ    R9, R4, R8

registers:
r00:    0       100     24      124     76      48      24      576
r08:    0       76      0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
```

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```
156:    1        2        3        4


====================
cycle:12       148      NOP

registers:
r00:    0        100      24       124      76       48       24       576
r08:    0        76       0        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
156:    1        2        3        4

====================
cycle:13       152      BREAK

registers:
r00:    0        100      24       124      76       48       24       576
r08:    0        76       0        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
156:    1        2        3        4
```

```
0 01000 00000 00001 00000 00000 001010   96        Invalid Instruction
1 01000 00000 00001 00000 00000 001010   100        ADDI    R1, R0, #10
1 01011 00000 00001 00000 00100 001000   104        SW      R1, 264(R0)
0 00010 10000 00000 00000 00000 000000   108        Invalid Instruction
1 00011 00000 00001 00000 00100 001000   112        LW      R1, 264(R0)
1 00001 00001 00000 00000 00000 001100   116        BLTZ    R1, #48
1 00000 00000 00001 01010 00010 000000   120        SLL     R10, R1, #2
1 00011 01010 00011 00010 101100          124        LW      R3, 172(R10)
1 00011 01010 00100 00000 00011 011000   128        LW      R4, 216(R10)
1 00011 00000 00101 00000 00100 000100   132        LW      R5, 260(R0)
1 00001 00011 00000 00000 00000 000010   136        BLTZ    R3, #8
1 00000 00100 00101 00110 00000 100010   140        SUB     R6, R4, R5
1 00010 00000 00000 00000 00000 100110   144        J       #152
1 00000 00100 00101 00110 00000 100000   148        ADD     R6, R4, R5
1 01011 01010 00110 00000 00010 101100   152        SW      R6, 172(R10)
1 01000 00001 00001 11111 11111 111111   156        ADDI    R1, R1, #-1
1 01011 00000 00001 00000 00100 001000   160        SW      R1, 264(R0)
1 00010 00000 00000 00000 00000 011100   164        J       #112
1 00000 00000 00000 00000 00000 001101   168        BREAK
00000000000000000000000000000001          172        1
00000000000000000000000000000011          176        3
11111111111111111111111111111101          180        -3
11111111111111111111111111111111          184        -1
11111111111111111111111111111110          188        -2
00000000000000000000000000000011          192        3
00000000000000000000000000000000          196        0
00000000000000000000000000000000          200        0
00000000000000000000000000000101          204        5
11111111111111111111111111111011          208        -5
00000000000000000000000000000110          212        6
00000000000000000000000000000000          216        0
00000000000000000000000000000000          220        0
00000000000000000000000000000000          224        0
00000000000000000000000000000000          228        0
00000000000000000000000000000000          232        0
00000000000000000000000000000000          236        0
00000000000000000000000000000000          240        0
00000000000000000000000000000000          244        0
00000000000000000000000000000000          248        0
00000000000000000000000000000000          252        0
00000000000000000000000000000000          256        0
00000000000000000000000000000010          260        2
00000000000000000000000000000000          264        0
```

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```
===================
cycle:1 100     ADDI    R1, R0, #10

registers:
r00:    0       10      0       0       0       0       0       0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    5       -5      6       0       0       0       0       0
236:    0       0       0       0       0       0       2       0

===================
cycle:2 104     SW      R1, 264(R0)

registers:
r00:    0       10      0       0       0       0       0       0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    5       -5      6       0       0       0       0       0
236:    0       0       0       0       0       0       2       10

===================
cycle:3 112     LW      R1, 264(R0)

registers:
r00:    0       10      0       0       0       0       0       0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    5       -5      6       0       0       0       0       0
236:    0       0       0       0       0       0       2       10

===================
cycle:4 116     BLTZ    R1, #48

registers:
r00:    0       10      0       0       0       0       0       0
r08:    0       0       0       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    5       -5      6       0       0       0       0       0
236:    0       0       0       0       0       0       2       10

===================
cycle:5 120     SLL     R10, R1, #2

registers:
r00:    0       10      0       0       0       0       0       0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0
```

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```
data:
172:    1        3       -3      -1      -2      3       0       0
204:    5       -5        6       0       0       0       0       0
236:    0        0        0       0       0       0       2      10


===================
cycle:6 124     LW      R3, 172(R10)

registers:
r00:    0       10        0       6       0       0       0       0
r08:    0        0       40       0       0       0       0       0
r16:    0        0        0       0       0       0       0       0
r24:    0        0        0       0       0       0       0       0

data:
172:    1        3       -3      -1      -2      3       0       0
204:    5       -5        6       0       0       0       0       0
236:    0        0        0       0       0       0       2      10


===================
cycle:7 128     LW      R4, 216(R10)

registers:
r00:    0       10        0       6       0       0       0       0
r08:    0        0       40       0       0       0       0       0
r16:    0        0        0       0       0       0       0       0
r24:    0        0        0       0       0       0       0       0

data:
172:    1        3       -3      -1      -2      3       0       0
204:    5       -5        6       0       0       0       0       0
236:    0        0        0       0       0       0       2      10


===================
cycle:8 132     LW      R5, 260(R0)

registers:
r00:    0       10        0       6       0       2       0       0
r08:    0        0       40       0       0       0       0       0
r16:    0        0        0       0       0       0       0       0
r24:    0        0        0       0       0       0       0       0

data:
172:    1        3       -3      -1      -2      3       0       0
204:    5       -5        6       0       0       0       0       0
236:    0        0        0       0       0       0       2      10


===================
cycle:9 136     BLTZ    R3, #8

registers:
r00:    0       10        0       6       0       2       0       0
r08:    0        0       40       0       0       0       0       0
r16:    0        0        0       0       0       0       0       0
r24:    0        0        0       0       0       0       0       0

data:
172:    1        3       -3      -1      -2      3       0       0
204:    5       -5        6       0       0       0       0       0
236:    0        0        0       0       0       0       2      10


===================
cycle:10        140     SUB     R6, R4, R5

registers:
```

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```
r00:    0      10     0      6      0      2      -2     0
r08:    0      0      40     0      0      0      0      0
r16:    0      0      0      0      0      0      0      0
r24:    0      0      0      0      0      0      0      0

data:
172:    1      3      -3     -1     -2     3      0      0
204:    5      -5     6      0      0      0      0      0
236:    0      0      0      0      0      0      2      10

===================
cycle:11      144     J      #152

registers:
r00:    0      10     0      6      0      2      -2     0
r08:    0      0      40     0      0      0      0      0
r16:    0      0      0      0      0      0      0      0
r24:    0      0      0      0      0      0      0      0

data:
172:    1      3      -3     -1     -2     3      0      0
204:    5      -5     6      0      0      0      0      0
236:    0      0      0      0      0      0      2      10

===================
cycle:12      152     SW     R6, 172(R10)

registers:
r00:    0      10     0      6      0      2      -2     0
r08:    0      0      40     0      0      0      0      0
r16:    0      0      0      0      0      0      0      0
r24:    0      0      0      0      0      0      0      0

data:
172:    1      3      -3     -1     -2     3      0      0
204:    5      -5     -2     0      0      0      0      0
236:    0      0      0      0      0      0      2      10

===================
cycle:13      156     ADDI   R1, R1, #-1

registers:
r00:    0      9      0      6      0      2      -2     0
r08:    0      0      40     0      0      0      0      0
r16:    0      0      0      0      0      0      0      0
r24:    0      0      0      0      0      0      0      0

data:
172:    1      3      -3     -1     -2     3      0      0
204:    5      -5     -2     0      0      0      0      0
236:    0      0      0      0      0      0      2      10

===================
cycle:14      160     SW     R1, 264(R0)

registers:
r00:    0      9      0      6      0      2      -2     0
r08:    0      0      40     0      0      0      0      0
r16:    0      0      0      0      0      0      0      0
r24:    0      0      0      0      0      0      0      0

data:
172:    1      3      -3     -1     -2     3      0      0
204:    5      -5     -2     0      0      0      0      0
236:    0      0      0      0      0      0      2      9
```

```
====================
cycle:15        164     J       #112

registers:
r00:    0       9       0       6       0       2       -2      0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    5       -5      -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       9

====================
cycle:16        112     LW      R1, 264(R0)

registers:
r00:    0       9       0       6       0       2       -2      0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    5       -5      -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       9

====================
cycle:17        116     BLTZ    R1, #48

registers:
r00:    0       9       0       6       0       2       -2      0
r08:    0       0       40      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    5       -5      -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       9

====================
cycle:18        120     SLL     R10, R1, #2

registers:
r00:    0       9       0       6       0       2       -2      0
r08:    0       0       36      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    5       -5      -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       9

====================
cycle:19        124     LW      R3, 172(R10)

registers:
r00:    0       9       0       -5      0       2       -2      0
r08:    0       0       36      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0
```

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```
data:
172:    1       3      -3      -1      -2       3       0       0
204:    5      -5      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       9


==================
cycle:20        128     LW      R4, 216(R10)

registers:
r00:    0       9       0      -5       0       2      -2       0
r08:    0       0      36       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1      -2       3       0       0
204:    5      -5      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       9


==================
cycle:21        132     LW      R5, 260(R0)

registers:
r00:    0       9       0      -5       0       2      -2       0
r08:    0       0      36       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1      -2       3       0       0
204:    5      -5      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       9


==================
cycle:22        136     BLTZ    R3, #8

registers:
r00:    0       9       0      -5       0       2      -2       0
r08:    0       0      36       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1      -2       3       0       0
204:    5      -5      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       9


==================
cycle:23        148     ADD     R6, R4, R5

registers:
r00:    0       9       0      -5       0       2       2       0
r08:    0       0      36       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1      -2       3       0       0
204:    5      -5      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       9


==================
cycle:24        152     SW      R6, 172(R10)
```

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```
registers:
r00:    0        9        0       -5        0        2        2        0
r08:    0        0       36        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1       -2        3        0        0
204:    5        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        9

====================
cycle:25        156      ADDI    R1, R1, #-1

registers:
r00:    0        8        0       -5        0        2        2        0
r08:    0        0       36        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1       -2        3        0        0
204:    5        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        9

====================
cycle:26        160      SW      R1, 264(R0)

registers:
r00:    0        8        0       -5        0        2        2        0
r08:    0        0       36        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1       -2        3        0        0
204:    5        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        8

====================
cycle:27        164      J       #112

registers:
r00:    0        8        0       -5        0        2        2        0
r08:    0        0       36        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1       -2        3        0        0
204:    5        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        8

====================
cycle:28        112      LW      R1, 264(R0)

registers:
r00:    0        8        0       -5        0        2        2        0
r08:    0        0       36        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1       -2        3        0        0
204:    5        2       -2        0        0        0        0        0
```

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```
236:     0         0         0         0         0         0         2         8


==================
cycle:29          116       BLTZ     R1, #48

registers:
r00:     0         8         0        -5         0         2         2         0
r08:     0         0         36        0         0         0         0         0
r16:     0         0         0         0         0         0         0         0
r24:     0         0         0         0         0         0         0         0

data:
172:     1         3        -3        -1        -2         3         0         0
204:     5         2        -2         0         0         0         0         0
236:     0         0         0         0         0         0         2         8


==================
cycle:30          120       SLL      R10, R1, #2

registers:
r00:     0         8         0        -5         0         2         2         0
r08:     0         0         32        0         0         0         0         0
r16:     0         0         0         0         0         0         0         0
r24:     0         0         0         0         0         0         0         0

data:
172:     1         3        -3        -1        -2         3         0         0
204:     5         2        -2         0         0         0         0         0
236:     0         0         0         0         0         0         2         8


==================
cycle:31          124       LW       R3, 172(R10)

registers:
r00:     0         8         0         5         0         2         2         0
r08:     0         0         32        0         0         0         0         0
r16:     0         0         0         0         0         0         0         0
r24:     0         0         0         0         0         0         0         0

data:
172:     1         3        -3        -1        -2         3         0         0
204:     5         2        -2         0         0         0         0         0
236:     0         0         0         0         0         0         2         8


==================
cycle:32          128       LW       R4, 216(R10)

registers:
r00:     0         8         0         5         0         2         2         0
r08:     0         0         32        0         0         0         0         0
r16:     0         0         0         0         0         0         0         0
r24:     0         0         0         0         0         0         0         0

data:
172:     1         3        -3        -1        -2         3         0         0
204:     5         2        -2         0         0         0         0         0
236:     0         0         0         0         0         0         2         8


==================
cycle:33          132       LW       R5, 260(R0)

registers:
r00:     0         8         0         5         0         2         2         0
r08:     0         0         32        0         0         0         0         0
r16:     0         0         0         0         0         0         0         0
```

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```
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3       -3       -1       -2        3        0        0
204:     5        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        8

===================
cycle:34        136        BLTZ    R3, #8

registers:
r00:     0        8        0        5        0        2        2        0
r08:     0        0       32        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3       -3       -1       -2        3        0        0
204:     5        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        8

===================
cycle:35        140        SUB     R6, R4, R5

registers:
r00:     0        8        0        5        0        2       -2        0
r08:     0        0       32        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3       -3       -1       -2        3        0        0
204:     5        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        8

===================
cycle:36        144        J       #152

registers:
r00:     0        8        0        5        0        2       -2        0
r08:     0        0       32        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3       -3       -1       -2        3        0        0
204:     5        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        8

===================
cycle:37        152        SW      R6, 172(R10)

registers:
r00:     0        8        0        5        0        2       -2        0
r08:     0        0       32        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3       -3       -1       -2        3        0        0
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        8

===================
cycle:38        156        ADDI    R1, R1, #-1
```

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```
registers:
r00:    0       7       0       5       0       2       -2      0
r08:    0       0       32      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       8

===================
cycle:39        160     SW      R1, 264(R0)

registers:
r00:    0       7       0       5       0       2       -2      0
r08:    0       0       32      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       7

===================
cycle:40        164     J       #112

registers:
r00:    0       7       0       5       0       2       -2      0
r08:    0       0       32      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       7

===================
cycle:41        112     LW      R1, 264(R0)

registers:
r00:    0       7       0       5       0       2       -2      0
r08:    0       0       32      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       7

===================
cycle:42        116     BLTZ    R1, #48

registers:
r00:    0       7       0       5       0       2       -2      0
r08:    0       0       32      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       0
```

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```
204:    -2       2       -2       0       0       0       0       0
236:     0       0        0       0       0       0       2       7


===================
cycle:43       120     SLL     R10, R1, #2

registers:
r00:     0       7       0       5       0       2      -2       0
r08:     0       0      28       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     1       3      -3      -1      -2       3       0       0
204:    -2       2      -2       0       0       0       0       0
236:     0       0       0       0       0       0       2       7


===================
cycle:44       124     LW      R3, 172(R10)

registers:
r00:     0       7       0       0       0       2      -2       0
r08:     0       0      28       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     1       3      -3      -1      -2       3       0       0
204:    -2       2      -2       0       0       0       0       0
236:     0       0       0       0       0       0       2       7


===================
cycle:45       128     LW      R4, 216(R10)

registers:
r00:     0       7       0       0       0       2      -2       0
r08:     0       0      28       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     1       3      -3      -1      -2       3       0       0
204:    -2       2      -2       0       0       0       0       0
236:     0       0       0       0       0       0       2       7


===================
cycle:46       132     LW      R5, 260(R0)

registers:
r00:     0       7       0       0       0       2      -2       0
r08:     0       0      28       0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     1       3      -3      -1      -2       3       0       0
204:    -2       2      -2       0       0       0       0       0
236:     0       0       0       0       0       0       2       7


===================
cycle:47       136     BLTZ    R3, #8

registers:
r00:     0       7       0       0       0       2      -2       0
r08:     0       0      28       0       0       0       0       0
```

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```
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1       -2       3        0        0
204:   -2        2       -2       0        0        0        0        0
236:    0        0        0        0        0        0        2        7

===================
cycle:48        140       SUB      R6, R4, R5

registers:
r00:    0        7        0        0        0        2       -2        0
r08:    0        0        28       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1       -2       3        0        0
204:   -2        2       -2       0        0        0        0        0
236:    0        0        0        0        0        0        2        7

===================
cycle:49        144       J        #152

registers:
r00:    0        7        0        0        0        2       -2        0
r08:    0        0        28       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1       -2       3        0        0
204:   -2        2       -2       0        0        0        0        0
236:    0        0        0        0        0        0        2        7

===================
cycle:50        152       SW       R6, 172(R10)

registers:
r00:    0        7        0        0        0        2       -2        0
r08:    0        0        28       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1       -2       3        0       -2
204:   -2        2       -2       0        0        0        0        0
236:    0        0        0        0        0        0        2        7

===================
cycle:51        156       ADDI     R1, R1, #-1

registers:
r00:    0        6        0        0        0        2       -2        0
r08:    0        0        28       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1       -2       3        0       -2
204:   -2        2       -2       0        0        0        0        0
236:    0        0        0        0        0        0        2        7

===================
```

```
cycle:52        160     SW      R1, 264(R0)

registers:
r00:    0       6       0       0       0       2       -2      0
r08:    0       0       28      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       6

===================
cycle:53        164     J       #112

registers:
r00:    0       6       0       0       0       2       -2      0
r08:    0       0       28      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       6

===================
cycle:54        112     LW      R1, 264(R0)

registers:
r00:    0       6       0       0       0       2       -2      0
r08:    0       0       28      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       6

===================
cycle:55        116     BLTZ    R1, #48

registers:
r00:    0       6       0       0       0       2       -2      0
r08:    0       0       28      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       6

===================
cycle:56        120     SLL     R10, R1, #2

registers:
r00:    0       6       0       0       0       2       -2      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
```

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```
172:     1       3       -3      -1      -2      3       0       -2
204:     -2      2       -2      0       0       0       0       0
236:     0       0       0       0       0       0       2       6

===================
cycle:57        124     LW      R3, 172(R10)

registers:
r00:     0       6       0       0       0       2       -2      0
r08:     0       0       24      0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     1       3       -3      -1      -2      3       0       -2
204:     -2      2       -2      0       0       0       0       0
236:     0       0       0       0       0       0       2       6

===================
cycle:58        128     LW      R4, 216(R10)

registers:
r00:     0       6       0       0       0       2       -2      0
r08:     0       0       24      0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     1       3       -3      -1      -2      3       0       -2
204:     -2      2       -2      0       0       0       0       0
236:     0       0       0       0       0       0       2       6

===================
cycle:59        132     LW      R5, 260(R0)

registers:
r00:     0       6       0       0       0       2       -2      0
r08:     0       0       24      0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     1       3       -3      -1      -2      3       0       -2
204:     -2      2       -2      0       0       0       0       0
236:     0       0       0       0       0       0       2       6

===================
cycle:60        136     BLTZ    R3, #8

registers:
r00:     0       6       0       0       0       2       -2      0
r08:     0       0       24      0       0       0       0       0
r16:     0       0       0       0       0       0       0       0
r24:     0       0       0       0       0       0       0       0

data:
172:     1       3       -3      -1      -2      3       0       -2
204:     -2      2       -2      0       0       0       0       0
236:     0       0       0       0       0       0       2       6

===================
cycle:61        140     SUB     R6, R4, R5

registers:
r00:     0       6       0       0       0       2       -2      0
```

64

```
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       6

===================
cycle:62        144     J       #152

registers:
r00:    0       6       0       0       0       2       -2      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       0       -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       6

===================
cycle:63        152     SW      R6, 172(R10)

registers:
r00:    0       6       0       0       0       2       -2      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       6

===================
cycle:64        156     ADDI    R1, R1, #-1

registers:
r00:    0       5       0       0       0       2       -2      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       6

===================
cycle:65        160     SW      R1, 264(R0)

registers:
r00:    0       5       0       0       0       2       -2      0
r08:    0       0       24      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       5
```

65

```
===================
cycle:66         164     J       #112

registers:
r00:    0       5       0       0       0       2      -2       0
r08:    0       0      24       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1      -2       3      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       5

===================
cycle:67         112     LW      R1, 264(R0)

registers:
r00:    0       5       0       0       0       2      -2       0
r08:    0       0      24       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1      -2       3      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       5

===================
cycle:68         116     BLTZ    R1, #48

registers:
r00:    0       5       0       0       0       2      -2       0
r08:    0       0      24       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1      -2       3      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       5

===================
cycle:69         120     SLL     R10, R1, #2

registers:
r00:    0       5       0       0       0       2      -2       0
r08:    0       0      20       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1      -2       3      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       5

===================
cycle:70         124     LW      R3, 172(R10)

registers:
r00:    0       5       0       3       0       2      -2       0
r08:    0       0      20       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0
```

66

```
data:
172:    1       3       -3      -1      -2      3       -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       5


===================
cycle:71        128     LW      R4, 216(R10)

registers:
r00:    0       5       0       3       0       2       -2      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       5


===================
cycle:72        132     LW      R5, 260(R0)

registers:
r00:    0       5       0       3       0       2       -2      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       5


===================
cycle:73        136     BLTZ    R3, #8

registers:
r00:    0       5       0       3       0       2       -2      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       5


===================
cycle:74        140     SUB     R6, R4, R5

registers:
r00:    0       5       0       3       0       2       -2      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      3       -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       5


===================
cycle:75        144     J       #152

registers:
```

67

```
r00:    0      5      0      3      0      2     -2      0
r08:    0      0     20      0      0      0      0      0
r16:    0      0      0      0      0      0      0      0
r24:    0      0      0      0      0      0      0      0

data:
172:    1      3     -3     -1     -2      3     -2     -2
204:   -2      2     -2      0      0      0      0      0
236:    0      0      0      0      0      0      2      5

===================
cycle:76        152     SW      R6, 172(R10)

registers:
r00:    0      5      0      3      0      2     -2      0
r08:    0      0     20      0      0      0      0      0
r16:    0      0      0      0      0      0      0      0
r24:    0      0      0      0      0      0      0      0

data:
172:    1      3     -3     -1     -2     -2     -2     -2
204:   -2      2     -2      0      0      0      0      0
236:    0      0      0      0      0      0      2      5

===================
cycle:77        156     ADDI    R1, R1, #-1

registers:
r00:    0      4      0      3      0      2     -2      0
r08:    0      0     20      0      0      0      0      0
r16:    0      0      0      0      0      0      0      0
r24:    0      0      0      0      0      0      0      0

data:
172:    1      3     -3     -1     -2     -2     -2     -2
204:   -2      2     -2      0      0      0      0      0
236:    0      0      0      0      0      0      2      5

===================
cycle:78        160     SW      R1, 264(R0)

registers:
r00:    0      4      0      3      0      2     -2      0
r08:    0      0     20      0      0      0      0      0
r16:    0      0      0      0      0      0      0      0
r24:    0      0      0      0      0      0      0      0

data:
172:    1      3     -3     -1     -2     -2     -2     -2
204:   -2      2     -2      0      0      0      0      0
236:    0      0      0      0      0      0      2      4

===================
cycle:79        164     J       #112

registers:
r00:    0      4      0      3      0      2     -2      0
r08:    0      0     20      0      0      0      0      0
r16:    0      0      0      0      0      0      0      0
r24:    0      0      0      0      0      0      0      0

data:
172:    1      3     -3     -1     -2     -2     -2     -2
204:   -2      2     -2      0      0      0      0      0
236:    0      0      0      0      0      0      2      4
```

```
===================
cycle:80        112      LW      R1, 264(R0)

registers:
r00:    0       4       0       3       0       2       -2      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       4

===================
cycle:81        116      BLTZ    R1, #48

registers:
r00:    0       4       0       3       0       2       -2      0
r08:    0       0       20      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       4

===================
cycle:82        120      SLL     R10, R1, #2

registers:
r00:    0       4       0       3       0       2       -2      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       4

===================
cycle:83        124      LW      R3, 172(R10)

registers:
r00:    0       4       0       -2      0       2       -2      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       4

===================
cycle:84        128      LW      R4, 216(R10)

registers:
r00:    0       4       0       -2      0       2       -2      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0
```

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```
data:
172:    1       3       -3      -1      -2      -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       4

===================
cycle:85       132      LW      R5, 260(R0)

registers:
r00:    0       4       0       -2      0       2       -2      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       4

===================
cycle:86       136      BLTZ    R3, #8

registers:
r00:    0       4       0       -2      0       2       -2      0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       4

===================
cycle:87       148      ADD     R6, R4, R5

registers:
r00:    0       4       0       -2      0       2       2       0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      -2      -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       4

===================
cycle:88       152      SW      R6, 172(R10)

registers:
r00:    0       4       0       -2      0       2       2       0
r08:    0       0       16      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      -1      2       -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       4

===================
cycle:89       156      ADDI    R1, R1, #-1
```

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```
registers:
r00:    0       3       0      -2       0       2       2       0
r08:    0       0      16       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1       2      -2      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       4

===================
cycle:90        160     SW      R1, 264(R0)

registers:
r00:    0       3       0      -2       0       2       2       0
r08:    0       0      16       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1       2      -2      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       3

===================
cycle:91        164     J       #112

registers:
r00:    0       3       0      -2       0       2       2       0
r08:    0       0      16       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1       2      -2      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       3

===================
cycle:92        112     LW      R1, 264(R0)

registers:
r00:    0       3       0      -2       0       2       2       0
r08:    0       0      16       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1       2      -2      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       3

===================
cycle:93        116     BLTZ    R1, #48

registers:
r00:    0       3       0      -2       0       2       2       0
r08:    0       0      16       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3      -3      -1       2      -2      -2      -2
204:   -2       2      -2       0       0       0       0       0
```

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```
236:    0        0        0        0        0        0        2        3


==================
cycle:94         120      SLL      R10, R1, #2

registers:
r00:    0        3        0       -2        0        2        2        0
r08:    0        0        12       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1        2       -2       -2       -2
204:   -2        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        3


==================
cycle:95         124      LW       R3, 172(R10)

registers:
r00:    0        3        0       -1        0        2        2        0
r08:    0        0        12       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1        2       -2       -2       -2
204:   -2        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        3


==================
cycle:96         128      LW       R4, 216(R10)

registers:
r00:    0        3        0       -1        0        2        2        0
r08:    0        0        12       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1        2       -2       -2       -2
204:   -2        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        3


==================
cycle:97         132      LW       R5, 260(R0)

registers:
r00:    0        3        0       -1        0        2        2        0
r08:    0        0        12       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1        2       -2       -2       -2
204:   -2        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        3


==================
cycle:98         136      BLTZ     R3, #8

registers:
r00:    0        3        0       -1        0        2        2        0
r08:    0        0        12       0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
```

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```
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1        2       -2       -2       -2
204:   -2        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        3

===================
cycle:99        148       ADD      R6, R4, R5

registers:
r00:    0        3        0       -1        0        2        2        0
r08:    0        0       12        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3       -1        2       -2       -2       -2
204:   -2        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        3

===================
cycle:100       152       SW       R6, 172(R10)

registers:
r00:    0        3        0       -1        0        2        2        0
r08:    0        0       12        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3        2        2       -2       -2       -2
204:   -2        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        3

===================
cycle:101       156       ADDI     R1, R1, #-1

registers:
r00:    0        2        0       -1        0        2        2        0
r08:    0        0       12        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3        2        2       -2       -2       -2
204:   -2        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        3

===================
cycle:102       160       SW       R1, 264(R0)

registers:
r00:    0        2        0       -1        0        2        2        0
r08:    0        0       12        0        0        0        0        0
r16:    0        0        0        0        0        0        0        0
r24:    0        0        0        0        0        0        0        0

data:
172:    1        3       -3        2        2       -2       -2       -2
204:   -2        2       -2        0        0        0        0        0
236:    0        0        0        0        0        0        2        2

===================
cycle:103       164       J        #112
```

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```
registers:
r00:    0       2       0       -1      0       2       2       0
r08:    0       0       12      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      2       2       -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       2

===================
cycle:104       112     LW      R1, 264(R0)

registers:
r00:    0       2       0       -1      0       2       2       0
r08:    0       0       12      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      2       2       -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       2

===================
cycle:105       116     BLTZ    R1, #48

registers:
r00:    0       2       0       -1      0       2       2       0
r08:    0       0       12      0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      2       2       -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       2

===================
cycle:106       120     SLL     R10, R1, #2

registers:
r00:    0       2       0       -1      0       2       2       0
r08:    0       0       8       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      2       2       -2      -2      -2
204:    -2      2       -2      0       0       0       0       0
236:    0       0       0       0       0       0       2       2

===================
cycle:107       124     LW      R3, 172(R10)

registers:
r00:    0       2       0       -3      0       2       2       0
r08:    0       0       8       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1       3       -3      2       2       -2      -2      -2
```

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```
204:    -2      2      -2      0      0      0      0      0
236:     0      0       0      0      0      0      2      2

===================
cycle:108       128     LW      R4, 216(R10)

registers:
r00:     0      2       0     -3      0      2      2      0
r08:     0      0       8      0      0      0      0      0
r16:     0      0       0      0      0      0      0      0
r24:     0      0       0      0      0      0      0      0

data:
172:     1      3      -3      2      2     -2     -2     -2
204:    -2      2      -2      0      0      0      0      0
236:     0      0       0      0      0      0      2      2

===================
cycle:109       132     LW      R5, 260(R0)

registers:
r00:     0      2       0     -3      0      2      2      0
r08:     0      0       8      0      0      0      0      0
r16:     0      0       0      0      0      0      0      0
r24:     0      0       0      0      0      0      0      0

data:
172:     1      3      -3      2      2     -2     -2     -2
204:    -2      2      -2      0      0      0      0      0
236:     0      0       0      0      0      0      2      2

===================
cycle:110       136     BLTZ    R3, #8

registers:
r00:     0      2       0     -3      0      2      2      0
r08:     0      0       8      0      0      0      0      0
r16:     0      0       0      0      0      0      0      0
r24:     0      0       0      0      0      0      0      0

data:
172:     1      3      -3      2      2     -2     -2     -2
204:    -2      2      -2      0      0      0      0      0
236:     0      0       0      0      0      0      2      2

===================
cycle:111       148     ADD     R6, R4, R5

registers:
r00:     0      2       0     -3      0      2      2      0
r08:     0      0       8      0      0      0      0      0
r16:     0      0       0      0      0      0      0      0
r24:     0      0       0      0      0      0      0      0

data:
172:     1      3      -3      2      2     -2     -2     -2
204:    -2      2      -2      0      0      0      0      0
236:     0      0       0      0      0      0      2      2

===================
cycle:112       152     SW      R6, 172(R10)

registers:
r00:     0      2       0     -3      0      2      2      0
r08:     0      0       8      0      0      0      0      0
```

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```
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3        2        2        2       -2       -2       -2
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        2

===================
cycle:113       156      ADDI     R1, R1, #-1

registers:
r00:     0        1        0       -3        0        2        2        0
r08:     0        0        8        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3        2        2        2       -2       -2       -2
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        2

===================
cycle:114       160      SW       R1, 264(R0)

registers:
r00:     0        1        0       -3        0        2        2        0
r08:     0        0        8        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3        2        2        2       -2       -2       -2
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        1

===================
cycle:115       164      J        #112

registers:
r00:     0        1        0       -3        0        2        2        0
r08:     0        0        8        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3        2        2        2       -2       -2       -2
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        1

===================
cycle:116       112      LW       R1, 264(R0)

registers:
r00:     0        1        0       -3        0        2        2        0
r08:     0        0        8        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3        2        2        2       -2       -2       -2
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        1

===================
```

```
cycle:117          116      BLTZ     R1, #48

registers:
r00:     0          1        0       -3        0        2        2        0
r08:     0          0        8        0        0        0        0        0
r16:     0          0        0        0        0        0        0        0
r24:     0          0        0        0        0        0        0        0

data:
172:     1          3        2        2        2       -2       -2       -2
204:    -2          2       -2        0        0        0        0        0
236:     0          0        0        0        0        0        2        1

===================
cycle:118          120      SLL      R10, R1, #2

registers:
r00:     0          1        0       -3        0        2        2        0
r08:     0          0        4        0        0        0        0        0
r16:     0          0        0        0        0        0        0        0
r24:     0          0        0        0        0        0        0        0

data:
172:     1          3        2        2        2       -2       -2       -2
204:    -2          2       -2        0        0        0        0        0
236:     0          0        0        0        0        0        2        1

===================
cycle:119          124      LW       R3, 172(R10)

registers:
r00:     0          1        0        3        0        2        2        0
r08:     0          0        4        0        0        0        0        0
r16:     0          0        0        0        0        0        0        0
r24:     0          0        0        0        0        0        0        0

data:
172:     1          3        2        2        2       -2       -2       -2
204:    -2          2       -2        0        0        0        0        0
236:     0          0        0        0        0        0        2        1

===================
cycle:120          128      LW       R4, 216(R10)

registers:
r00:     0          1        0        3        0        2        2        0
r08:     0          0        4        0        0        0        0        0
r16:     0          0        0        0        0        0        0        0
r24:     0          0        0        0        0        0        0        0

data:
172:     1          3        2        2        2       -2       -2       -2
204:    -2          2       -2        0        0        0        0        0
236:     0          0        0        0        0        0        2        1

===================
cycle:121          132      LW       R5, 260(R0)

registers:
r00:     0          1        0        3        0        2        2        0
r08:     0          0        4        0        0        0        0        0
r16:     0          0        0        0        0        0        0        0
r24:     0          0        0        0        0        0        0        0

data:
```

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```
172:     1        3        2        2        2       -2       -2       -2
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        1

===================
cycle:122       136     BLTZ    R3, #8

registers:
r00:     0        1        0        3        0        2        2        0
r08:     0        0        4        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3        2        2        2       -2       -2       -2
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        1

===================
cycle:123       140     SUB     R6, R4, R5

registers:
r00:     0        1        0        3        0        2       -2        0
r08:     0        0        4        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3        2        2        2       -2       -2       -2
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        1

===================
cycle:124       144     J       #152

registers:
r00:     0        1        0        3        0        2       -2        0
r08:     0        0        4        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1        3        2        2        2       -2       -2       -2
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        1

===================
cycle:125       152     SW      R6, 172(R10)

registers:
r00:     0        1        0        3        0        2       -2        0
r08:     0        0        4        0        0        0        0        0
r16:     0        0        0        0        0        0        0        0
r24:     0        0        0        0        0        0        0        0

data:
172:     1       -2        2        2        2       -2       -2       -2
204:    -2        2       -2        0        0        0        0        0
236:     0        0        0        0        0        0        2        1

===================
cycle:126       156     ADDI    R1, R1, #-1

registers:
r00:     0        0        0        3        0        2       -2        0
```

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```
r08:    0       0       4       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1      -2       2       2       2      -2      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       1

===================
cycle:127       160     SW      R1, 264(R0)

registers:
r00:    0       0       0       3       0       2      -2       0
r08:    0       0       4       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1      -2       2       2       2      -2      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       0

===================
cycle:128       164     J       #112

registers:
r00:    0       0       0       3       0       2      -2       0
r08:    0       0       4       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1      -2       2       2       2      -2      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       0

===================
cycle:129       112     LW      R1, 264(R0)

registers:
r00:    0       0       0       3       0       2      -2       0
r08:    0       0       4       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1      -2       2       2       2      -2      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       0

===================
cycle:130       116     BLTZ    R1, #48

registers:
r00:    0       0       0       3       0       2      -2       0
r08:    0       0       4       0       0       0       0       0
r16:    0       0       0       0       0       0       0       0
r24:    0       0       0       0       0       0       0       0

data:
172:    1      -2       2       2       2      -2      -2      -2
204:   -2       2      -2       0       0       0       0       0
236:    0       0       0       0       0       0       2       0
```

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```
===================
cycle:131      120      SLL     R10, R1, #2

registers:
r00:    0        0        0        3        0        2       -2       0
r08:    0        0        0        0        0        0        0       0
r16:    0        0        0        0        0        0        0       0
r24:    0        0        0        0        0        0        0       0

data:
172:    1       -2        2        2        2       -2       -2      -2
204:   -2        2       -2        0        0        0        0       0
236:    0        0        0        0        0        0        2       0

===================
cycle:132      124      LW      R3, 172(R10)

registers:
r00:    0        0        0        1        0        2       -2       0
r08:    0        0        0        0        0        0        0       0
r16:    0        0        0        0        0        0        0       0
r24:    0        0        0        0        0        0        0       0

data:
172:    1       -2        2        2        2       -2       -2      -2
204:   -2        2       -2        0        0        0        0       0
236:    0        0        0        0        0        0        2       0

===================
cycle:133      128      LW      R4, 216(R10)

registers:
r00:    0        0        0        1        0        2       -2       0
r08:    0        0        0        0        0        0        0       0
r16:    0        0        0        0        0        0        0       0
r24:    0        0        0        0        0        0        0       0

data:
172:    1       -2        2        2        2       -2       -2      -2
204:   -2        2       -2        0        0        0        0       0
236:    0        0        0        0        0        0        2       0

===================
cycle:134      132      LW      R5, 260(R0)

registers:
r00:    0        0        0        1        0        2       -2       0
r08:    0        0        0        0        0        0        0       0
r16:    0        0        0        0        0        0        0       0
r24:    0        0        0        0        0        0        0       0

data:
172:    1       -2        2        2        2       -2       -2      -2
204:   -2        2       -2        0        0        0        0       0
236:    0        0        0        0        0        0        2       0

===================
cycle:135      136      BLTZ    R3, #8

registers:
r00:    0        0        0        1        0        2       -2       0
r08:    0        0        0        0        0        0        0       0
r16:    0        0        0        0        0        0        0       0
r24:    0        0        0        0        0        0        0       0
```

```
data:
172:     1       -2      2       2       2       -2      -2      -2
204:    -2        2     -2       0       0        0       0       0
236:     0        0      0       0       0        0       2       0


===================
cycle:136      140      SUB     R6, R4, R5

registers:
r00:     0        0      0       1       0        2      -2       0
r08:     0        0      0       0       0        0       0       0
r16:     0        0      0       0       0        0       0       0
r24:     0        0      0       0       0        0       0       0

data:
172:     1       -2      2       2       2       -2      -2      -2
204:    -2        2     -2       0       0        0       0       0
236:     0        0      0       0       0        0       2       0


===================
cycle:137      144      J       #152

registers:
r00:     0        0      0       1       0        2      -2       0
r08:     0        0      0       0       0        0       0       0
r16:     0        0      0       0       0        0       0       0
r24:     0        0      0       0       0        0       0       0

data:
172:     1       -2      2       2       2       -2      -2      -2
204:    -2        2     -2       0       0        0       0       0
236:     0        0      0       0       0        0       2       0


===================
cycle:138      152      SW      R6, 172(R10)

registers:
r00:     0        0      0       1       0        2      -2       0
r08:     0        0      0       0       0        0       0       0
r16:     0        0      0       0       0        0       0       0
r24:     0        0      0       0       0        0       0       0

data:
172:    -2       -2      2       2       2       -2      -2      -2
204:    -2        2     -2       0       0        0       0       0
236:     0        0      0       0       0        0       2       0


===================
cycle:139      156      ADDI    R1, R1, #-1

registers:
r00:     0       -1      0       1       0        2      -2       0
r08:     0        0      0       0       0        0       0       0
r16:     0        0      0       0       0        0       0       0
r24:     0        0      0       0       0        0       0       0

data:
172:    -2       -2      2       2       2       -2      -2      -2
204:    -2        2     -2       0       0        0       0       0
236:     0        0      0       0       0        0       2       0


===================
cycle:140      160      SW      R1, 264(R0)

registers:
```

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```
r00:    0      -1     0      1      0      2     -2      0
r08:    0       0     0      0      0      0      0      0
r16:    0       0     0      0      0      0      0      0
r24:    0       0     0      0      0      0      0      0

data:
172:   -2      -2     2      2      2     -2     -2     -2
204:   -2       2    -2      0      0      0      0      0
236:    0       0     0      0      0      0      2     -1

===================
cycle:141      164     J      #112

registers:
r00:    0      -1     0      1      0      2     -2      0
r08:    0       0     0      0      0      0      0      0
r16:    0       0     0      0      0      0      0      0
r24:    0       0     0      0      0      0      0      0

data:
172:   -2      -2     2      2      2     -2     -2     -2
204:   -2       2    -2      0      0      0      0      0
236:    0       0     0      0      0      0      2     -1

===================
cycle:142      112     LW     R1, 264(R0)

registers:
r00:    0      -1     0      1      0      2     -2      0
r08:    0       0     0      0      0      0      0      0
r16:    0       0     0      0      0      0      0      0
r24:    0       0     0      0      0      0      0      0

data:
172:   -2      -2     2      2      2     -2     -2     -2
204:   -2       2    -2      0      0      0      0      0
236:    0       0     0      0      0      0      2     -1

===================
cycle:143      116     BLTZ   R1, #48

registers:
r00:    0      -1     0      1      0      2     -2      0
r08:    0       0     0      0      0      0      0      0
r16:    0       0     0      0      0      0      0      0
r24:    0       0     0      0      0      0      0      0

data:
172:   -2      -2     2      2      2     -2     -2     -2
204:   -2       2    -2      0      0      0      0      0
236:    0       0     0      0      0      0      2     -1

===================
cycle:144      168     BREAK

registers:
r00:    0      -1     0      1      0      2     -2      0
r08:    0       0     0      0      0      0      0      0
r16:    0       0     0      0      0      0      0      0
r24:    0       0     0      0      0      0      0      0

data:
172:   -2      -2     2      2      2     -2     -2     -2
204:   -2       2    -2      0      0      0      0      0
236:    0       0     0      0      0      0      2     -1
```

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