CREATOR: a tool for teaching assembly programming with RISC-V

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Universidad Carlos III de Madrid. Spain RISC-V Summit Europe Barcelona Universidad ARCOS RISC Carlos III uc3m Monday-Friday de Madrid 5-9 June 2023 CREATOR E About of Didactic simulator specially designed for students and teachers. ٠ 1 Multiplatform: o It runs on a web browser without a server (desktops, tablets, and smartphones). It also allows command line execution. + Integrated environment for editing, compiling, executing, and debugging assembly programs. MIPS-32 The MIPS proces developed by Hennessey and his students at University in the ear RISC-V (RV32IMFD) Support for creating teaching material, generates URLs with the programs created. Allows to load the of an already antiplication Possibility to define and work with different architectures and assembly languages. • • Currently: MIPS and RISC-V (RV32IMFD). Integration with ESP32-C3 microcontroller. **Edit and Compile** R 3.3 RISC-V (RV3 CREATOR 33 RISC-V (RV32IMFD) Architecture * Øg Simulator Architecture + 06 Simulator +) Co ile/Linked Copy Cut Paste Arguments Resul Assembly:
 Assembly:
 text
 main: • Assembly: Print_int Print_float Print_double Print_string Read_int Read_float Read_double Read_string a0 = integer fa0 = float Select a 11 t0, 10 11 t1, 13 11 t2, 45 11 t3, 33 1i t0, 10 1i t1, 13 1i t2, 45 1i t3, 33 Unde Redo Integer in a0 Float in fa0 Double in fa0 addx t4, t0, t1 # 10+1 sub t4, t2, t3 # 45-33 mul t4, t3, t3 # 33-33 div t4, t2, t0 # 45/10 addx t4, t0, t1 # 10+11 web t4, t2, t3 # 45-33 mel t4, t3, t3 # 33*33 div t4, t2, t0 # 45/10 Сору URL generation with a0 = string a1 = length a0 = length examples for teaching materials Sbrk Address in a0 # print
nv a0,
li a7,
ecall # print mv s0, li s7, ecall a0 = ASCII code Char in a0 **Run and Debug** Program loaded in memory with easy
 User
 Second visualization of labels. Test. Execution flow knowing the current and next × 5 CT IS 1 CT IS Heng th C2 world multiple tail 16 M to 255 add c7 mm add mm C1 add c1 K IS Heng sh callenged 2 ms instruction at all times (useful in loops, branching instructions, and function calls). Stack memory has not been relea ed successfully · Parameter passing convention and stack usage with alerts when it is not followed Possible failure in the parameter passing **Details** FP Registers 🔳 Stats 🗲 Energy (CLK Cycles) INT/CTRL Registers 📷 Memory elect space Stats view Signed Unsign Float Char Unsig. IEEE 754 Hax. eger Signed Name Alias Stack Graphic Table PC 📭 Binary Cancel OK zero | x0 e tp | x4 e fp | s0 | x8 e 00 00 00 18 24 ø (1041) 41 94 7A E1 18.56 GeoFFFF factorial Hex. Binary Signed Unsig. Char IEEE 754 (48 65 6C 6C H, e, l, l factoria main a6 | x12 a a6 | x16 a s4 | x20 o s8 | x24 o a7 | x17 a s5 | x21 a s9 | x25 o 85.00.00.00 0.0 00C - 0x00200005 (11444C) CO 2A E6 66 -13.45 areas: Q Callee: Caller: --- System factorial factorial 1 stack Integration with ESP32-C3 microcontroller
 Procession
 Procession

 <t Flash Flash to microcontroller Monitor Execution on microcontroller Target Board Flash iguring flash size... h will be erased from KubBookob to BuBbbSiff... h will be erased from KubBookob to BuBbbSiff... h will be erased from KubBookob to BuBbbSiff... ressed 20552 bytes to 12074... ig at KubBookob... (180 %) e 20592 bytes (12574 compressed) at BuBbBOOKOB in (5)... SPRESSIF Fight this behavior from Becomesses to Researching devertional 2000 Wine 1500 A. West 2000 yes 1500 yes 1500 yes 1500 A. West 2000 yes 1500 yes 1500 yes 1500 yes 150 (1) Select Target Br ESP32-C3 P32-C3 (RISC-V) Rur (2) Target Port: (please (3) Flash URL: http://localhost:8080 >Factorial(7) = 5040 Finished program: 46546 cycles Leaving... Hard resetting via RTS pin... Done 127.0.0.1 - (29/May/2023 09:07:47) "POST /flash HTTP/1.1" 200

