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CS 311

Lab 04

Documentation

Segment data:

1. Step 1(line 8): assign the decimal value 112, 67, and 121 to the field of type word
2. Step 2(line 9): initialize the field sum to 0 and set it as a memory to store the sum
3. Step 3(line 10): initialize the field sum to 0 and set it as a memory to store the sum

Main:

Addition:

1. Step 1(line 15): set the value of rcx to 0 because for some reason the value of rcx and rbx in my program starts at 1.
2. Step 2(line 16): move the value of the first number in field a (112) to rax. In this case, we use movzx instead of mov because the memory type of the variable a is word and the value is positive. To be able to move value of type word to rax which is 2 bytes to 8 bytes (smaller to bigger register), we should use movzx or movsx. Instead of only [a], the right side should be written as word[a] (because the data type is word). [a] means the first index of the array in field a which is 112.
3. Step 3(line 17): add the current value of rax to rcx. The value is based on the previous 2 lines. rax value at this point is 112 and rcx is 0. The value of addition is stored into rcx which is 112 while the value in rax stays the same (112).
4. Step 4(line 18): move the value of the second number in field a which is 67 to rax. It replaces the previous value 112 with the new value 67. In this case, we use movzx again because of the same reason as fifth step. In this step, [a+2] means the second index of the array in field a which is 67. It’s a+2 because the type of the field is word. If for example it’s doubleword, we should add 4 instead of 2 for every value (a+4, a+8 etc).
5. Step 5(line 19): add the current value of rax to rcx. The value is, again, based on the previous 2 lines. rax value at this point is 67(value of word[a+2]) and rcx is 112 based on line 17. The value 179(112+67) is stored into rcx while the value in rax stays the same (67).
6. Step 6(line 20): move the value of third number in field a which is 121 to rax. It replaces the previous value 67 with the new value 121. In this case, we use movzx again because of the same reason as fifth step. In this step, [a+4] means the third index of the array in field a which is 121. (adding 2(because of word) to a+2(second index) give us a+4, the third index).
7. Step 7(line 21): add the current value of rax to rcx. The value is, again, based on the previous 2 lines. rax value at this point is 121(value of word[a+4]) and rcx is 179 based on line 19. The value is stored into rcx which is 300(179+121) while the value in rax stays the same (121).
8. Step 8(line 22): move/store the value of rcx (300) to the field sum (the sum of all 3 numbers)

Subtraction:

1. Step 1(line 23): move the value of the first number in field a (112) to rax. It replaces the previous value 121 with the new value 112. In this case, we use movzx again because of the same reason as before. The meaning of [a] is also the same, first index.
2. Step 2(line 24): move the value of the second number in field a (67) to other register rbx. In this case, we use movzx again because of the same reason as before. The meaning of [a+2] is also the same, which is the second index.
3. Step 3(line 25): subtract the current value of rbx to rax. The value is, based on the previous 2 lines. rbx value at this point is 67(value of word[a+2]) and rax is 112 based on line 23. The value is stored into rax which is 45(112-67) while the value in rbx stays the same (67).
4. Step 4(line 26): move the value of third number in field a which is 121 to rbx. It replaces the previous value 67 with the new value 121. In this case, we use movzx again because of the same reason as before. The meaning of [a+4] is also the same, which is the third index.
5. Step 5(line 27): subtract the current value of rbx to rax. The value is, based on the previous 2 lines. rbx value at this point is 121(value of word[a+4]) and rax is 45 based on line 25. The value is stored into rax which is -76(45-121) while the value in rbx stays the same (121).
6. Step 6(line 28): move/store the value of rax (-76) to the field diff (difference between all 3 numbers, 112-67-121).

Closing steps:

Line 29: zero out the value in rax

Line 30: ret to close the program