Assignment 2 Report

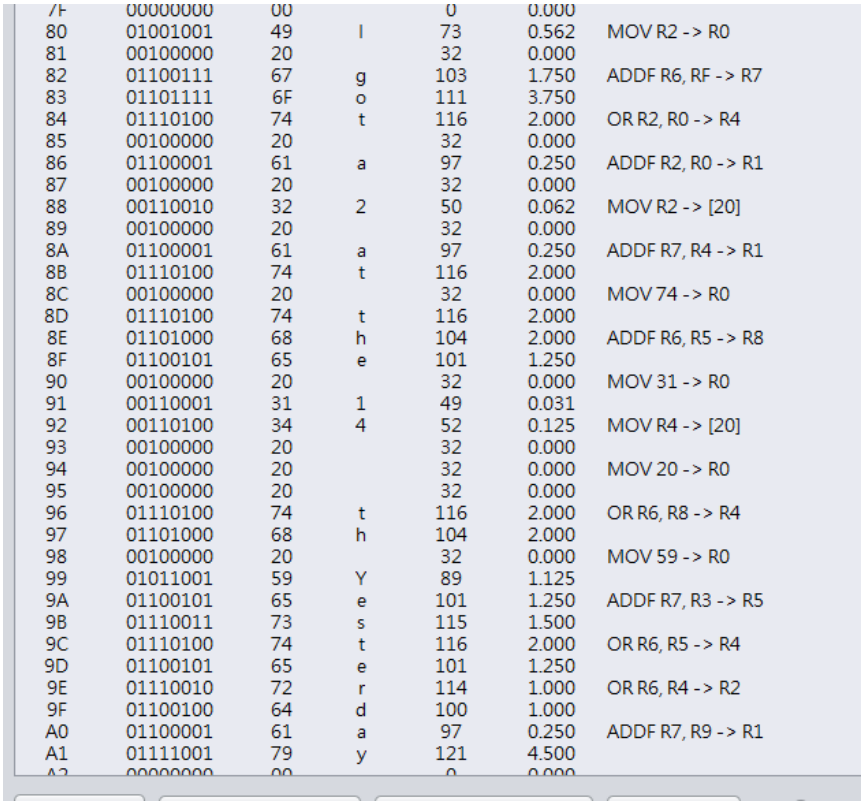
1. Switch case and compress spaces in a character sequence program chosen.
    a) The pseudocode for the program. (JavaTPoint, 2018) (pattis, N/A)

```
// The program goes through the string of characters
// and checks the ascii of each character and changes
// it accordingly or not depending on what it is.
// This is then added to a new string and that string is outputted.

data = passed into program the thing getting changed
iteratorSpace = 0
iteratorNewData = 0
newData = output for program currently null
currentAsciiValue = 0
i = 0
currentAsciiValue = (int) data[i]

while currentAsciiValue != 0 do

      if currentAsciiValue >= 65 and currentAsciiValue <= 90 then

            currentAsciiValue = currentAsciiValue + 32
            iteratorSpace = 0
            newData[iteratorNewData] = (char) currentAsciiValue
            iteratorNewData = iteratorNewData + 1

      else if currentAsciiValue >= 97 and currentAsciiValue <= 122 then

            currentAsciiValue = currentAsciiValue - 32
            iteratorSpace = 0
            newData[iteratorNewData] = (char) currentAsciiValue
            iteratorNewData = iteratorNewData + 1

      else if currentAsciiValue == 32 then

            iteratorSpace = iteratorSpace + 1

            if iteratorSpace == 1 then

                  newData[iteratorNewData] = (char) currentAsciiValue
                  iteratorNewData = iteratorNewData + 1

      else

            iteratorSpace = 0
            newData[iteratorNewData] = (char) currentAsciiValue
            iteratorNewData = iteratorNewData + 1

      endif

      i = i + 1
      currentAsciiValue = (int) data[i]
endwhile

newData[iteratorNewData] = 0
```

b) The assembly language program. (pattis, N/A) Assembler Help page in Brookshear machine used.

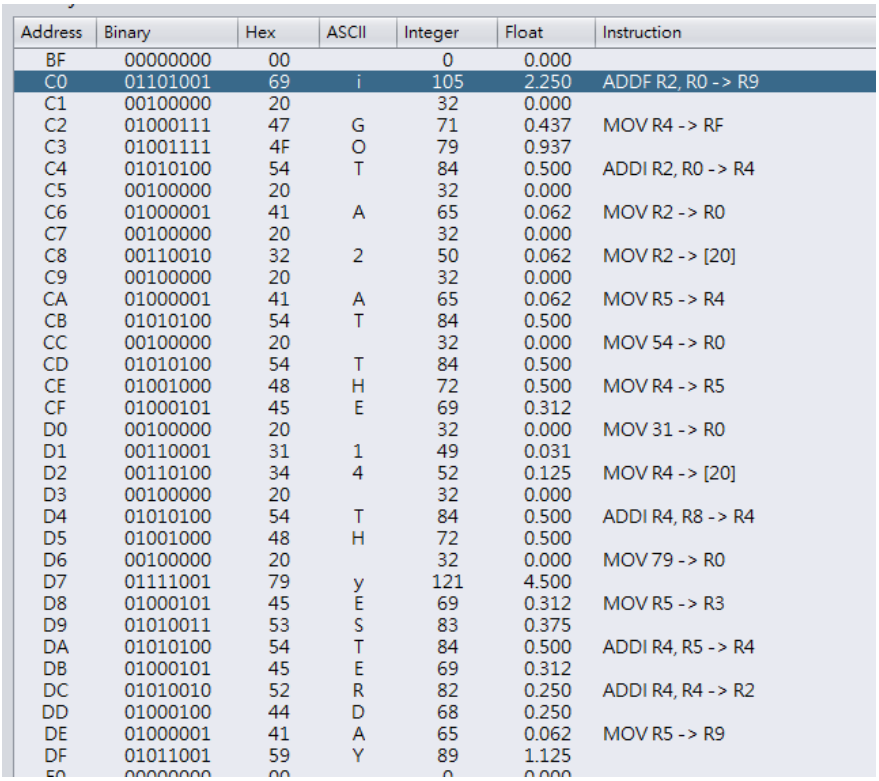
```
//Switch Case and compress character sequence
//by 198735
            mov   00 -> R0    //setup
            mov   [input] -> R1
            mov   [R1] -> R2
            mov   [output] -> R3
            mov   1 -> R4
            mov   0 -> R5
            mov   +32 -> R6
            mov   -32 -> R7
            mov   nocaps -> R8
            mov   space -> R9
            mov   else -> RA
            mov   newloop -> RB

startloop:  jmpeq endloop, R2 //start of while loop

caps:       mov   +65 -> R0   //converting value to capital
            jmplt R8, R2
            mov   +90 -> R0
            jmpgt   R8, R2          //jumps to nocaps

            addi  R2, R6 -> R2
            mov   0 -> R5
            mov   R2 -> [R3]
            addi  R3, R4 -> R3
            jmp   newloop

nocaps:           mov   +97 -> R0   //converting value to lowercase
            jmplt R9, R2
            mov   +122 -> R0
            jmpgt   R9, R2          //jumps to space

            addi  R2, R7 -> R2
            mov   0 -> R5
            mov   R2 -> [R3]
            addi  R3, R4 -> R3
            jmp   newloop

space:            mov   +32 -> R0   //checks if spaces >1
            jmpne   RA, R2
            addi  R5, R4 -> R5
            mov   1 -> R0
            jmpne       RB, R5      //if it is it doesn't add the space
            mov   R2 -> [R3]
            addi  R3, R4 -> R3
            jmp   newloop

else:       mov   0 -> R5
            mov   R2 -> [R3]
            addi  R3, R4 -> R3

newloop:    mov   00 -> R0    //resets R0 to 00 value
            addi  R1, R4 -> R1      //increments memory address from current
            mov   [R1] -> R2
            jmp   startloop   //end of while loop

endloop:    halt

input:      data        10000000    //input address (80)
output:     data        11000000    //output address (c0)
80: data          "I got a 2 at the 14   th  Yesterday"    //input strings
```

c) The character input at the start of the program



7F	00000000	00		0	0.000	
80	01001001	49	I	73	0.562	MOV R2 -> R0
81	00100000	20		32	0.000	
82	01100111	67	g	103	1.750	ADDF R6, RF -> R7
83	01101111	6F	o	111	3.750	
84	01110100	74	t	116	2.000	OR R2, R0 -> R4
85	00100000	20		32	0.000	
86	01100001	61	a	97	0.250	ADDF R2, R0 -> R1
87	00100000	20		32	0.000	
88	00110010	32	2	50	0.062	MOV R2 -> [20]
89	00100000	20		32	0.000	
8A	01100001	61	a	97	0.250	ADDF R7, R4 -> R1
8B	01110100	74	t	116	2.000	
8C	00100000	20		32	0.000	MOV 74 -> R0
8D	01110100	74	t	116	2.000	
8E	01101000	68	h	104	2.000	ADDF R6, R5 -> R8
8F	01100101	65	e	101	1.250	
90	00100000	20		32	0.000	MOV 31 -> R0
91	00110001	31	1	49	0.031	
92	00110100	34	4	52	0.125	MOV R4 -> [20]
93	00100000	20		32	0.000	
94	00100000	20		32	0.000	MOV 20 -> R0
95	00100000	20		32	0.000	
96	01110100	74	t	116	2.000	OR R6, R8 -> R4
97	01101000	68	h	104	2.000	
98	00100000	20		32	0.000	MOV 59 -> R0
99	01011001	59	Y	89	1.125	
9A	01100101	65	e	101	1.250	ADDF R7, R3 -> R5
9B	01110011	73	s	115	1.500	
9C	01110100	74	t	116	2.000	OR R6, R5 -> R4
9D	01100101	65	e	101	1.250	
9E	01110010	72	r	114	1.000	OR R6, R4 -> R2
9F	01100100	64	d	100	1.000	
A0	01100001	61	a	97	0.250	ADDF R7, R9 -> R1
A1	01111001	79	y	121	4.500	
A2	00000000	00		0	0.000	

The output at the end of the program



Address	Binary	Hex	ASCII	Integer	Float	Instruction
BF	00000000	00		0	0.000	
C0	01101001	69	i	105	2.250	ADDF R2, R0 -> R9
C1	00100000	20		32	0.000	
C2	01000111	47	G	71	0.437	MOV R4 -> RF
C3	01001111	4F	O	79	0.937	
C4	01010100	54	T	84	0.500	ADDI R2, R0 -> R4
C5	00100000	20		32	0.000	
C6	01000001	41	A	65	0.062	MOV R2 -> R0
C7	00100000	20		32	0.000	
C8	00110010	32	2	50	0.062	MOV R2 -> [20]
C9	00100000	20		32	0.000	
CA	01000001	41	A	65	0.062	MOV R5 -> R4
CB	01010100	54	T	84	0.500	
CC	00100000	20		32	0.000	MOV 54 -> R0
CD	01010100	54	T	84	0.500	
CE	01001000	48	H	72	0.500	MOV R4 -> R5
CF	01000101	45	E	69	0.312	
D0	00100000	20		32	0.000	MOV 31 -> R0
D1	00110001	31	1	49	0.031	
D2	00110100	34	4	52	0.125	MOV R4 -> [20]
D3	00100000	20		32	0.000	
D4	01010100	54	T	84	0.500	ADDI R4, R8 -> R4
D5	01001000	48	H	72	0.500	
D6	00100000	20		32	0.000	MOV 79 -> R0
D7	01111001	79	y	121	4.500	
D8	01000101	45	E	69	0.312	MOV R5 -> R3
D9	01010011	53	S	83	0.375	
DA	01010100	54	T	84	0.500	ADDI R4, R5 -> R4
DB	01000101	45	E	69	0.312	
DC	01010010	52	R	82	0.250	ADDI R4, R4 -> R2
DD	01000100	44	D	68	0.250	
DE	01000001	41	A	65	0.062	MOV R5 -> R9
DF	01011001	59	Y	89	1.125	
E0	00000000	00		0	0.000	

The program executes as specified in the brief and has 589 instructions with this input string above.

d) The use of the registers are as follows:
- R0 – stores the exit condition and the if conditions, as this is the default for all jump comparisons
- R1 – stores the current memory address for the input, i.e. the pointer for memory input
- R2 – stores the current input value, this is changed in the program and stored in the output string
- R3 – stores the current memory address for the output, i.e. the pointer for memory output
- R4 – stores a 1 used as an iterator for the memory addresses in R1 and R3 and used with R5
- R5 – stores the iterator for the spaces, used to decide whether there have been 2 or more spaces
- R6 – stores the add value, to convert from uppercase to lowercase i.e. +32.
- R7 – stores the minus value, to convert from lowercase to uppercase i.e. -32.
- R8 – stores the memory address of the nocaps label (seen in assembly code).
- R9 – stores the memory address of the space label (seen in assembly code).
- RA – stores the memory address of the else label (seen in assembly code).
- RB – stores the memory address of the newloop label (seen in assembly code).

The storage of memory address from R8 onwards is due to the assembly language not being able to take labels for certain JMP conditions, for example less than jump and the greater than jump.

The main jump is what forms the while loop as this keeps the program looping, this is the first jump you see in the program and is also the last instruction before halt, this jumps back to the top to check the condition again before making another iteration.

In the Pseudocode some of the IF statements have two conditions, hence the meaning of the less than and greater than jumps, as if it doesn't meet the condition it shouldn't execute the code below the jump. The jump statements also jump to the next if statement like the would in the Pseudocode above.

The not equals jump checks whether the character is a space and if it is then it can execute the code for space otherwise it can't. The jump after this then checks if it's the space is the first one or isn't which eliminates any extra spaces.

2.

a) An interpreter translates high-level language into machine code line by line, the CPU then executes each instruction before moving on to the next instruction. (BBC Bitesize, 2019) It is used for quick de-bugging of code, as the interpreter stops when it hits an error and allows programmers to test a section of code or even just a few lines. This is instead of potentially waiting several minutes waiting for the program to compile only to find it can't be built. Well-known languages that use interpreters include Python and JavaScript.

An interpreter maybe used in conjunction with a compiler in an IDE as both have benefits over the other in different areas. For example, run speed of a whole program is quicker with a compiler than an interpreter. Another example would be that when testing an interpreter uses less memory than a compiled program. (teach-ict, N/A) This allows the programmer to use the best tool for the job as they say, for a real world example, you can eat Baked beans with a fork, but its easier to eat them with a spoon. Therefore, the programmer may use the interpreter when developing their program, but when it comes to testing and finishing they may use the compiler to test the overall game. The compiler also has the edge here as it is harder for a user to get access to the source code of the program. And if one IDE doesn't do this then its not as functional as the one that does have both an interpreter and a compiler.

b) A disassembler converts an executable file into assembly language. It is the exact opposite of an assembler. It allows users to view individual commands and see how a program works. (Tech-FAQ, 2019) A programmer may use it to investigate a computer virus as this is no doubt some type of executable file. The disassembler can disassemble the program into assembly language and then the program can find a way to reverse whatever the virus does to the computer, a so called vaccine you could say. However, the disassembler doesn't name the variables nicely at all they are just numbers and letters, (The Computer Language Co Inc., N/A) because it cannot work out what the original person named the variable, disassembled code is also difficult to maintain and requires you to rename it and store it on your computer. This is potentially deadly for your computer as you have essentially put a virus on your computer.

References

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