

Subhan Khalid
p200086 BSCS 4A



Tasks

Task1

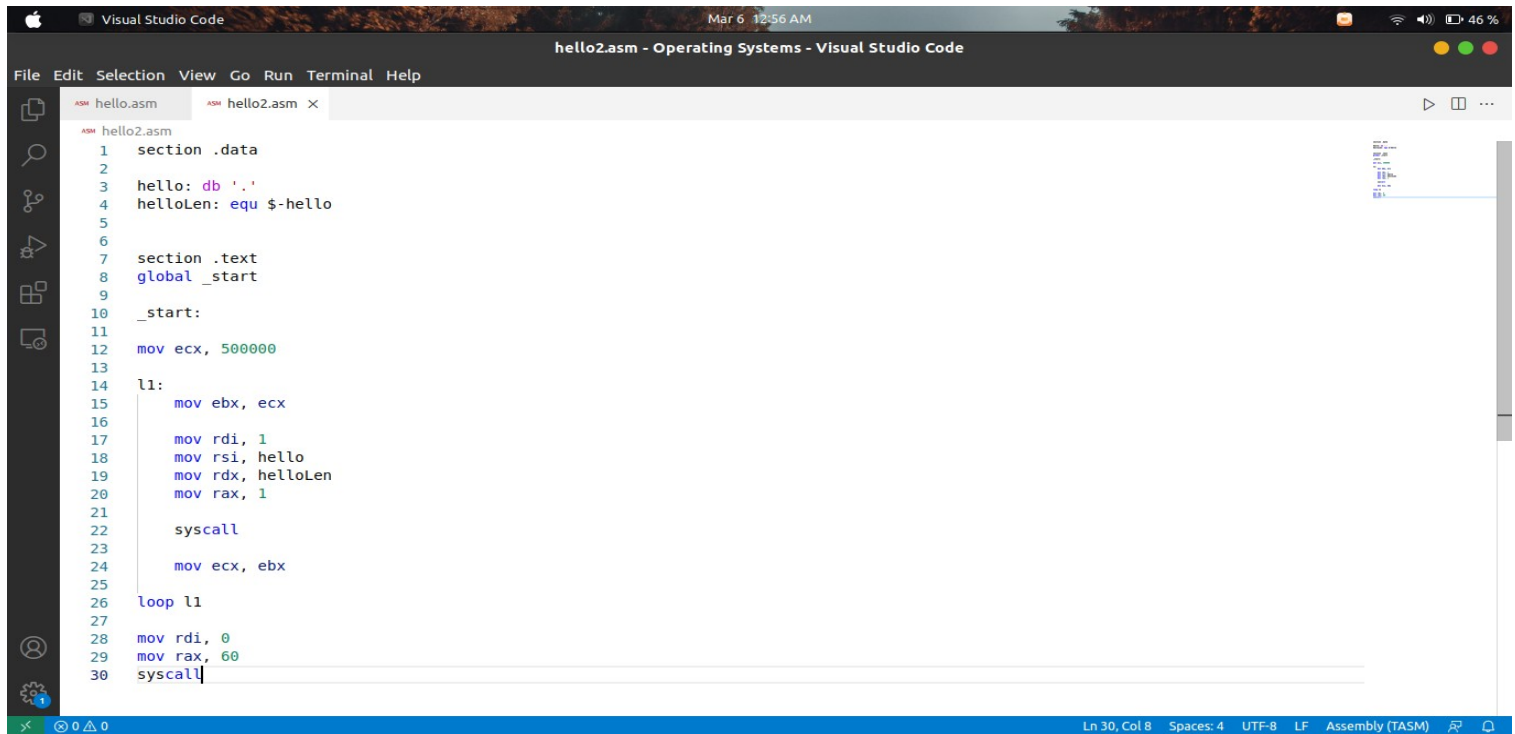
A screenshot of the Visual Studio Code editor interface. The title bar shows 'Visual Studio Code' and the date 'Mar 6 12:56 AM'. The main window title is 'hello.asm - Operating Systems - Visual Studio Code'. The editor displays assembly code for 'hello.asm'. The code includes a data section with a string 'hello', a text section with a loop, and a start routine. The status bar at the bottom indicates 'Ln 12, Col 13', 'Spaces: 4', 'UTF-8', 'LF', and 'Assembly (TASM)'.

```
1  section .data
2
3  hello: db '.',
4  helloLen: equ $-hello
5
6
7  section .text
8  global _start
9
10 _start:
11
12  mov ecx, 500000
13
14  l1:
15      mov esi, ecx
16
17      mov eax, 4
18      mov ebx, 1
19      mov ecx, hello
20      mov edx, helloLen
21      int 80h
22
23      mov ecx, esi
24
25  loop l1
26
27  mov eax, 1
28  mov ebx, 0
29  int 80h
```

```
+
abdul@abdul-HP-EliteBook-840-G4: ~/Documents/BSCS-4_semester/Operating Systems
abdul@abdul-HP-EliteBook-840-G4: ~/Documents/BSCS-4_semester/Operating Systems
abdul@abdul-HP-EliteBook-840-G4:~/Documents/BSCS-4_semester/Operating Systems$ nasm -f elf64 hello.asm
abdul@abdul-HP-EliteBook-840-G4:~/Documents/BSCS-4_semester/Operating Systems$ nasm -f elf64 hello.asm
abdul@abdul-HP-EliteBook-840-G4:~/Documents/BSCS-4_semester/Operating Systems$ ./hello
```

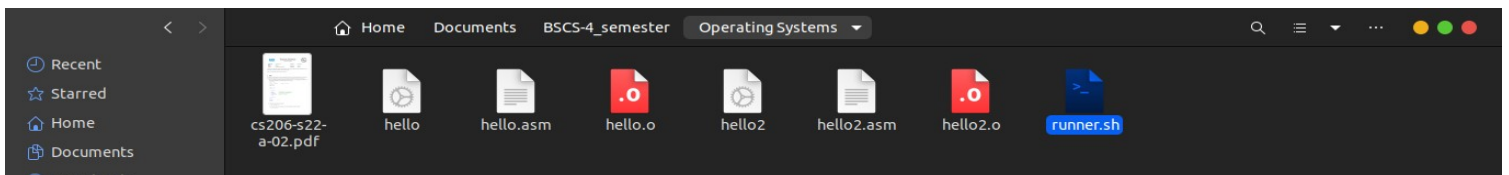
```
abdul@abdul-HP-EliteBook-840-G4:~/Documents/BSCS-4_semester/Operating Systems$ time ./hello > /dev/null
real    0m0.411s
user    0m0.239s
sys     0m0.171s
```

Task2



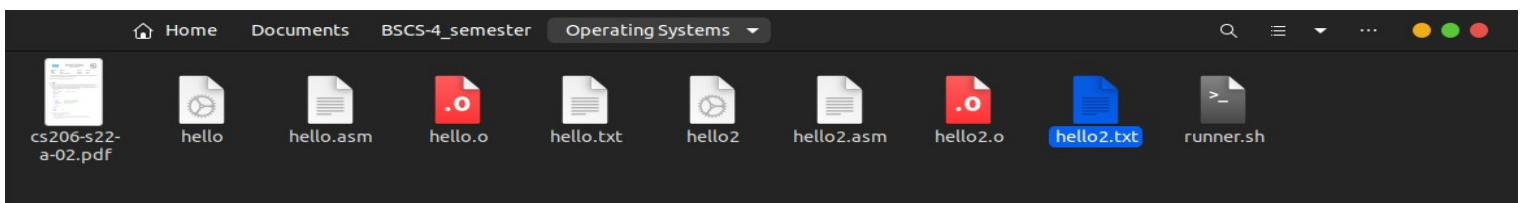
```
hello2.asm
1  section .data
2
3  hello: db '.',
4  helloLen: equ $-hello
5
6
7  section .text
8  global _start
9
10 _start:
11
12  mov ecx, 500000
13
14  l1:
15      mov ebx, ecx
16
17      mov rdi, 1
18      mov rsi, hello
19      mov rdx, helloLen
20      mov rax, 1
21
22      syscall
23
24      mov ecx, ebx
25
26  loop l1
27
28  mov rdi, 0
29  mov rax, 60
30  syscall
```

```
abdul@abdul-HP-EliteBook-840-G4:~/Documents/BSCS-4_semester/Operating Systems$ nasm -f elf64 -o hello.o hello.asm
abdul@abdul-HP-EliteBook-840-G4:~/Documents/BSCS-4_semester/Operating Systems$ nasm -f elf64 -o hello2.o hello2.asm
abdul@abdul-HP-EliteBook-840-G4:~/Documents/BSCS-4_semester/Operating Systems$ ld -s -o hello hello.o
abdul@abdul-HP-EliteBook-840-G4:~/Documents/BSCS-4_semester/Operating Systems$ ld -s -o hello2 hello2.o
```



```
abdul@abdul-HP-EliteBook-840-G4:~/Documents/BSCS-4_semester/Operating Systems$ chmod +x runner.sh
abdul@abdul-HP-EliteBook-840-G4:~/Documents/BSCS-4_semester/Operating Systems$ ./runner.sh
```

hello.txt & hello2.txt → files created



Text files

Open ▾ + hello2.txt ~/Documents/BSCS-4_semester/Operating Systems Save ... ● ● ●			Open ▾ + hello.txt ~/Documents/BSCS-4_semester/Operating Systems Save ... ● ● ●		
1			1		
2 real	0m0.323s		2 real	0m0.443s	
3 user	0m0.170s		3 user	0m0.254s	
4 sys	0m0.153s		4 sys	0m0.190s	
5			5		
6 real	0m0.303s		6 real	0m0.431s	
7 user	0m0.166s		7 user	0m0.210s	
8 sys	0m0.137s		8 sys	0m0.221s	
9			9		
10 real	0m0.319s		10 real	0m0.432s	
11 user	0m0.182s		11 user	0m0.232s	
12 sys	0m0.138s		12 sys	0m0.200s	
13			13		
14 real	0m0.317s		14 real	0m0.421s	
15 user	0m0.228s		15 user	0m0.232s	
16 sys	0m0.088s		16 sys	0m0.187s	
17			17		
18 real	0m0.316s		18 real	0m0.422s	
19 user	0m0.168s		19 user	0m0.245s	
20 sys	0m0.148s		20 sys	0m0.177s	
21			21		
22 real	0m0.308s		22 real	0m0.431s	
23 user	0m0.200s		23 user	0m0.280s	
24 sys	0m0.108s		24 sys	0m0.152s	
25			25		
26 real	0m0.321s		26 real	0m0.431s	
27 user	0m0.184s		27 user	0m0.264s	
28 sys	0m0.136s		28 sys	0m0.168s	
29			29		
30 real	0m0.313s		30 real	0m0.416s	
31 user	0m0.197s		31 user	0m0.268s	
32 sys	0m0.116s		32 sys	0m0.148s	
33			33		
34 real	0m0.315s		34 real	0m0.419s	
35 user	0m0.196s		35 user	0m0.232s	
36 sys	0m0.120s		36 sys	0m0.187s	
37			37		
38 real	0m0.310s		38 real	0m0.420s	
39 user	0m0.175s		39 user	0m0.244s	
40 sys	0m0.135s		40 sys	0m0.176s	
41			41		
42 real	0m0.312s		42 real	0m0.425s	
43 user	0m0.196s		43 user	0m0.239s	
44 sys	0m0.116s		44 sys	0m0.187s	
45			45		
46 real	0m0.321s		46 real	0m0.422s	
47 user	0m0.241s		47 user	0m0.258s	
48 sys	0m0.080s		48 sys	0m0.163s	
49			49		
50 real	0m0.319s		50 real	0m0.420s	
51 user	0m0.188s		51 user	0m0.212s	
52 sys	0m0.131s		52 sys	0m0.208s	
53			53		
54 real	0m0.308s		54 real	0m0.430s	
55 user	0m0.148s		55 user	0m0.259s	
56 sys	0m0.160s		56 sys	0m0.171s	
57			57		
58 real	0m0.318s		58 real	0m0.428s	
59 user	0m0.185s		59 user	0m0.268s	
60 sys	0m0.133s		60 sys	0m0.160s	
61			61		
62 real	0m0.332s		62 real	0m0.424s	
63 user	0m0.168s		63 user	0m0.243s	
64 sys	0m0.163s		64 sys	0m0.179s	
65			65		
66 real	0m0.317s		66 real	0m0.419s	
67 user	0m0.153s		67 user	0m0.200s	
68 sys	0m0.164s		68 sys	0m0.219s	
69			69		
70 real	0m0.319s		70 real	0m0.419s	
71 user	0m0.180s		71 user	0m0.256s	
72 sys	0m0.139s		72 sys	0m0.164s	

72	sys	0m0.139s	72	sys	0m0.164s
73			73		
74	real	0m0.313s	74	real	0m0.426s
75	user	0m0.178s	75	user	0m0.245s
76	sys	0m0.134s	76	sys	0m0.181s
77			77		
78	real	0m0.318s	78	real	0m0.423s
79	user	0m0.165s	79	user	0m0.247s
80	sys	0m0.150s	80	sys	0m0.175s
81			81		
82	real	0m0.314s	82	real	0m0.417s
83	user	0m0.149s	83	user	0m0.245s
84	sys	0m0.165s	84	sys	0m0.172s
85			85		
86	real	0m0.313s	86	real	0m0.421s
87	user	0m0.168s	87	user	0m0.197s
88	sys	0m0.144s	88	sys	0m0.224s
89			89		
90	real	0m0.314s	90	real	0m0.423s
91	user	0m0.191s	91	user	0m0.255s
92	sys	0m0.123s	92	sys	0m0.166s
93			93		
94	real	0m0.320s	94	real	0m0.420s
95	user	0m0.191s	95	user	0m0.232s
96	sys	0m0.127s	96	sys	0m0.188s
97			97		
98	real	0m0.321s	98	real	0m0.418s
99	user	0m0.185s	99	user	0m0.241s
100	sys	0m0.136s	100	sys	0m0.177s
101			101		
102	real	0m0.317s	102	real	0m0.476s
103	user	0m0.181s	103	user	0m0.260s
104	sys	0m0.136s	104	sys	0m0.216s
105			105		
106	real	0m0.326s	106	real	0m0.440s

106	real	0m0.326s	106	real	0m0.440s
107	user	0m0.217s	107	user	0m0.236s
108	sys	0m0.108s	108	sys	0m0.204s
109			109		
110	real	0m0.335s	110	real	0m0.464s
111	user	0m0.171s	111	user	0m0.296s
112	sys	0m0.163s	112	sys	0m0.168s
113			113		
114	real	0m0.319s	114	real	0m0.434s
115	user	0m0.193s	115	user	0m0.242s
116	sys	0m0.125s	116	sys	0m0.193s
117			117		
118	real	0m0.351s	118	real	0m0.468s
119	user	0m0.217s	119	user	0m0.248s
120	sys	0m0.133s	120	sys	0m0.219s
121			121		
122	real	0m0.346s	122	real	0m0.433s
123	user	0m0.191s	123	user	0m0.249s
124	sys	0m0.155s	124	sys	0m0.184s
125			125		
126	real	0m0.327s	126	real	0m0.422s
127	user	0m0.230s	127	user	0m0.205s
128	sys	0m0.097s	128	sys	0m0.217s
129			129		
130	real	0m0.318s	130	real	0m0.430s
131	user	0m0.186s	131	user	0m0.239s
132	sys	0m0.130s	132	sys	0m0.191s
133			133		
134	real	0m0.327s	134	real	0m0.417s
135	user	0m0.182s	135	user	0m0.201s
136	sys	0m0.145s	136	sys	0m0.216s
137			137		
138	real	0m0.319s	138	real	0m0.420s
139	user	0m0.228s	139	user	0m0.228s
140	sys	0m0.092s	140	sys	0m0.192s
141			141		

142	real	0m0.323s	142	real	0m0.441s
143	user	0m0.167s	143	user	0m0.226s
144	sys	0m0.155s	144	sys	0m0.214s
145			145		
146	real	0m0.326s	146	real	0m0.428s
147	user	0m0.189s	147	user	0m0.250s
148	sys	0m0.136s	148	sys	0m0.178s
149			149		
150	real	0m0.322s	150	real	0m0.423s
151	user	0m0.182s	151	user	0m0.250s
152	sys	0m0.141s	152	sys	0m0.173s
153			153		
154	real	0m0.321s	154	real	0m0.421s
155	user	0m0.198s	155	user	0m0.248s
156	sys	0m0.123s	156	sys	0m0.172s
157			157		
158	real	0m0.308s	158	real	0m0.422s
159	user	0m0.200s	159	user	0m0.281s
160	sys	0m0.108s	160	sys	0m0.140s
161			161		
162	real	0m0.330s	162	real	0m0.462s
163	user	0m0.167s	163	user	0m0.265s
164	sys	0m0.163s	164	sys	0m0.197s
165			165		
166	real	0m0.349s	166	real	0m0.465s
167	user	0m0.208s	167	user	0m0.313s
168	sys	0m0.140s	168	sys	0m0.152s
169			169		
170	real	0m0.335s	170	real	0m0.430s
171	user	0m0.194s	171	user	0m0.259s
172	sys	0m0.141s	172	sys	0m0.171s
173			173		
174	real	0m0.322s	174	real	0m0.417s
175	user	0m0.199s	175	user	0m0.201s
176	sys	0m0.123s	176	sys	0m0.216s
177			177		
178	real	0m0.341s	178	real	0m0.467s
179	user	0m0.192s	179	user	0m0.224s
180	sys	0m0.149s	180	sys	0m0.244s
181			181		
182	real	0m0.334s	182	real	0m0.425s
183	user	0m0.185s	183	user	0m0.264s
184	sys	0m0.149s	184	sys	0m0.161s
185			185		
186	real	0m0.345s	186	real	0m0.425s
187	user	0m0.177s	187	user	0m0.266s
188	sys	0m0.168s	188	sys	0m0.159s
189			189		
190	real	0m0.310s	190	real	0m0.424s
191	user	0m0.209s	191	user	0m0.218s
192	sys	0m0.100s	192	sys	0m0.206s
193			193		
194	real	0m0.313s	194	real	0m0.416s
195	user	0m0.177s	195	user	0m0.232s
196	sys	0m0.136s	196	sys	0m0.184s
197			197		
198	real	0m0.315s	198	real	0m0.414s
199	user	0m0.179s	199	user	0m0.271s
200	sys	0m0.135s	200	sys	0m0.143s

Average of the user time taken across the 50 experiments.

Avg → hello.txt

0.253+0.280+0.251+0.224+0.220+0.247+0.236+0.241+0.271+0.224+0.210+0.238+0....	=	12.139
12.139÷50	=	0.24278
0.24278		
7	8	9
4	5	6
1	2	3
0	.	%
÷	×	-
+	=	

Avg → hello2.txt

0.323+0.166+0.182+0.228+0.168+0.200+0.184+0.197+0.196+0.175+0.196+0.241+0....	=	9.524
9.524÷50	=	0.19048
0.19048		
7	8	9
4	5	6
1	2	3
0	.	%
÷	×	-
+	=	

Number of experiments run: N
Average 'user time' for hello (int-based calls): I
Average 'user time' for hello2 (syscall-based calls): S

Percentage speedup: $(I-S)*100/I$

N = 50

I = 0.24278

S = 0.19048

percentage = 21.542136914

$0.24278 - 0.19048$	=	0.0523
---------------------	---	---------------

0.0523×100	=	5.23
---------------------	---	-------------

$5.23 \div 0.24278$	=	21.54213...
---------------------	---	--------------------