

3.1 [2 points] Typescript for compilation

```
project4 — -zsh — 80x24
[zhangjunteng@zhangjuntengdeMacBook-Air project4 % ls
Makefile      preemptive.c    preemptive.h    test3threads.c
[zhangjunteng@zhangjuntengdeMacBook-Air project4 % make
sdcc -c test3threads.c
test3threads.c:65: warning 158: overflow in implicit constant conversion
sdcc -c preemptive.c
preemptive.c:184: warning 85: in function ThreadCreate unreferenced function argument : 'fp'
preemptive.c:226: warning 158: overflow in implicit constant conversion
sdcc -o test3threads.hex test3threads.rel preemptive.rel
[zhangjunteng@zhangjuntengdeMacBook-Air project4 % ls
Makefile      preemptive.rst    test3threads.lst
preemptive.asm preemptive.sym    test3threads.map
preemptive.c   test3threads.asm  test3threads.mem
preemptive.h   test3threads.c    test3threads.rel
preemptive.lst test3threads.hex  test3threads.rst
preemptive.rel test3threads.lk    test3threads.sym
[zhangjunteng@zhangjuntengdeMacBook-Air project4 % make clean
rm *.hex *.ihx *.lnk *.lst *.map *.mem *.rel *.rst *.sym *.asm *.lk
rm: *.ihx: No such file or directory
rm: *.lnk: No such file or directory
make: *** [clean] Error 1
zhangjunteng@zhangjuntengdeMacBook-Air project4 %
```

3.2 [18 points] Screenshots and explanation

test3threads.map

Value	Global	Global Defined In Module			
Hexadecimal [32-Bits]					
Area	Addr	Size	Decimal	Bytes	(Attributes)
CSEG	00000014	000003B7 =	951.	bytes	(REL,CON,CODE)
Value	Global	Global Defined In Module			
C: 00000014	_Producer1	test3threads			
C: 0000006D	_Producer2	test3threads			
C: 000000C6	_Consumer	test3threads			
C: 0000010D	_main	test3threads			
C: 0000012E	_sdcc_gsinit_startup	test3threads			
C: 00000132	_mcs51_genRAMCLEAR	test3threads			
C: 00000133	_mcs51_genXINIT	test3threads			
C: 00000134	_mcs51_genXRAMCLEAR	test3threads			
C: 00000135	_timer0_ISR	test3threads			
C: 00000139	_Bootstrap	preemptive			
C: 0000015F	_myTimer0Handler	preemptive			
C: 000001F5	_ThreadCreate	preemptive			
C: 0000026F	_ThreadYield	preemptive			
C: 000002D7	_ThreadExit	preemptive			
C: 00000348	_moduint	_moduint			
C: 00000395	_modsint	_modsint			

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- Take screenshots when the Producer1 and Producer2 running and show semaphore changes.

```

__data __at(0x20) char buffer[3];
__data __at(0x23) char Token;
__data __at(0x24) int full;
__data __at(0x26) char mutex;
__data __at(0x27) int empty;
__data __at(0x29) char Token2;
__data __at(0x2A) char turn;
__data __at(0x2B) char turn2;
__data __at(0x30) int in;
__data __at(0x32) int out;

```

Observing full, Empty and mutex, their address could change during the process!

Turn is used to determined which processes running

Producer1:

EdSim51DI - Version 2.1.29 | test3threads.hex

System Clock (MHz) 11.0592 | 1000 Update Freq.

SBUF

R/O W/O TH0 TL0 R7 0x02 B 0x00

0x00 0x00 0x03 0x0F R6 0x00 ACC 0x00

RXD TXD TMOD 0x20 R5 0x00 PSW 0x08

1 1 TCON 0xD0 R4 0x00 IP 0x00

SCON 0x50 R3 0x00 IE 0x82

pins bits TH1 TL1 R2 0x00 PCON 0x00

0xFF 0xFF P3 0xFA 0xFA R1 0x01 DPH 0x00

0xFF 0xFF P2 PC 0x0014 PSW 0 0 0 0 1 0 0 0

0xFF 0xFF P1 0xFF 0xFF R0 0x35 DPL 0x00

0xFF 0xFF P0 SP 0x4F

8051

Data Memory

addr	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00	34	34	00	00	00	00	00	01	35	01	00	00	00	00	00	02
10	34	35	00	00	00	00	00	00	00	00	00	00	00	00	00	00
20	01	00	00	00	00	00	01	03	00	00	01	00	00	00	00	00
30	00	00	00	00	46	56	66	00	07	01	41	02	00	00	00	00
40	D5	00	00	00	02	00	90	34	00	00	00	00	00	00	00	00
50	14	00	00	00	00	00	09	00	00	00	00	00	00	00	00	00
60	6D	00	00	00	00	00	11	00	00	00	00	00	00	00	00	00
70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

Remove All Breakpoints

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Time: 9ms 21us - Instructions: 5538

```

ORG 0000H
LJMP 012EH
0003 RETI
ORG 000BH
000B LJMP 0135H
000E LJMP 010DH
0011 LJMP 000EH
0014* MOV 23H, #41H
0017 MOV A, 2AH
0019 JZ 0FCH
001B JB 0E7H, 0F9H
001E DEC 2AH
0020 MOV A, 27H
0022 JZ 0FCH
0024 JB 0E7H, 0F9H
0027 DEC 27H
0029 MOV A, 26H
002B JZ 0FCH
002D JB 0E7H, 0F9H
0030 DEC 26H
0032 MOV A, 30H
0034 ADD A, #20H
0036 MOV R0, A
0037 MOV @R0, 23H

```

Producer2:

EdSim51DI - Version 2.1.29 | test3threads.hex

System Clock (MHz) 11.0592 | 1000 Update Freq.

SBUF

R/O W/O TH0 TL0 R7 0x00 B 0x00

0x00 0x00 0x03 0x12 R6 0x00 ACC 0x00

RXD TXD TMOD 0x20 R5 0x00 PSW 0x10

1 1 TCON 0xD0 R4 0x00 IP 0x00

SCON 0x50 R3 0x00 IE 0x82

pins bits TH1 TL1 R2 0x00 PCON 0x00

0xFF 0xFF P3 0xFA 0xFF R1 0x35 DPH 0x00

0xFF 0xFF P2 PC 0x006D PSW 0 0 0 1 0 0 0 0

0xFF 0xFF P1 0xFF 0xFF R0 0x34 DPL 0x00

8051

Data Memory

addr	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
00	34	34	00	00	00	00	00	01	35	00	00	00	00	00	00	02
10	34	35	00	00	00	00	00	00	00	00	00	00	00	00	00	00
20	01	00	00	41	00	00	01	03	00	00	01	00	00	00	00	00
30	00	00	00	00	46	56	66	00	07	02	41	02	00	00	00	00
40	D5	00	00	00	02	00	90	34	00	00	00	00	00	00	00	00
50	17	00	00	00	00	00	08	35	01	00	00	00	00	00	02	00
60	6D	00	00	00	00	00	11	00	00	00	00	00	00	00	00	00
70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

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Time: 17ms 913us - Instructions: 11000

```

MOV 03H, 31H
003F INC DPTR
0040 MOV 08H, #03H
0043 MOV 09H, #00H
0046 LCALL 0395H
0049 MOV 30H, 82H
004C MOV 31H, 83H
004F MOV A, #5AH
0051 CJNE A, 23H, 06H
0054 MOV R6, #41H
0056 MOV R7, #00H
0058 SJMP 09H
005A MOV R5, 23H
005C INC R5
005D MOV A, R5
005E MOV R6, A
005F RLC A
0060 SUBB A, 0E0H
0062 MOV R7, A
0063 MOV 23H, R6
0065 INC 26H
0067 INC 24H
0069 INC 28H
006B SJMP 0AAH
006D* MOV 29H, #30H

```

- Take screenshots when the Consumer is running and show semaphore changes.

EdSim51DI - Version 2.1.29 | test3threads.hex

System Clock (MHz) 11.0592 10000 Update Freq.

SBUF

R/O W/O TH0 TL0 R7 0x00 B 0x00
0x00 0x00 0x07 0x03 R6 0x37 ACC 0x36
RXD TXD 1 1 TMOD 0x00 R5 0x37 PSW 0x90
SCON 0x00 TCON 0x10 R4 0x00 IP 0x00
pins bits TH1 TL1 R3 0x00 IE 0x82
0xFF 0xFF P3 0x00 0x00 R2 0x00 PCON 0x00
0xFF 0xFF P2 8051 R1 0x35 DPH 0x00
0xFF 0xFF P1 PC 0x00C6 i PSW 1 0 0 1 0 0 0 0
0xFF 0xFF P0 Modify RAM
Data Memory addr 0x00 0x00 value
0 1 2 3 4 5 6 7 8 9 A B C D E F
00 34 34 00 00 00 00 00 01 35 01 00 00 00 52 52 02
10 36 35 00 00 00 37 37 00 00 00 00 00 00 00 00 00
20 51 50 36 52 00 00 01 03 00 37 00 01 00 00 00 00
30 01 00 00 00 46 56 66 00 07 00 41 02 00 00 00 00
40 2B 01 00 00 00 00 00 34 22 00 00 00 37 37 00 00
50 14 00 00 00 00 00 09 35 00 00 00 00 51 51 00 00
60 6D 00 00 00 00 00 11 36 35 00 00 00 37 37 00 00
70 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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0099 | MOV 08H, 31H
0098 | INC DPTR
0099 | MOV 08H, #03H
009C | MOV 09H, #00H
009F | LCALL 0395H
00A2 | MOV 30H, 82H
00A5 | MOV 31H, 83H
00A8 | MOV A, #39H
00AA | CJNE A, 29H, 06H
00AD | MOV R6, #30H
00AF | MOV R7, #00H
00B1 | SJMP 09H
00B3 | MOV R5, 29H
00B5 | INC R5
00B6 | MOV A, R5
00B7 | MOV R6, A
00B8 | RLC A
00B9 | SUBB A, 0E0H
00BB | MOV R7, A
00BC | MOV 29H, R6
00BE | INC 26H
00C0 | INC 24H
00C2 | INC 2AH
00C4 | SJMP 0AAH
00C6* | CLR 0AFH

EdSim51DI - Version 2.1.29 | test3threads.hex

System Clock (MHz) 11.0592 10000 Update Freq.

SBUF

R/O W/O TH0 TL0 R7 0x00 B 0xFE
0x00 0x31 0x86 0x11 R6 0x43 ACC 0x00
RXD TXD 1 1 TMOD 0x20 R5 0x43 PSW 0x08
SCON 0x50 TCON 0xD0 R4 0x00 IP 0x00
pins bits TH1 TL1 R3 0x00 IE 0x82
0xFF 0xFF P3 0xFA 0xFD R2 0x00 PCON 0x00
0xFF 0xFF P2 8051 R1 0x00 DPH 0x00
0xFF 0xFF P1 PC 0x0017 i PSW 0 0 0 0 1 0 0 0
0xFF 0xFF P0 Modify RAM
Data Memory addr 0x00 0x00 value
0 1 2 3 4 5 6 7 8 9 A B C D E F
00 34 34 00 00 00 00 01 01 00 00 00 00 43 43 00
10 34 35 00 00 00 32 32 00 00 00 00 00 00 00 00
20 42 41 31 43 01 00 01 02 00 32 00 01 00 00 00 00
30 01 00 00 00 46 56 66 00 07 01 41 02 00 00 00 00
40 D5 00 00 00 00 90 34 22 00 00 00 32 32 00 00 00
50 49 00 BC 03 02 00 08 35 00 00 00 00 42 42 00 00
60 72 00 00 00 00 10 36 35 00 00 00 32 32 00 00 00
70 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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0017 | MOV A, 2AH
0019 | JZ 0FCH
001B | JB 0E7H, 0F9H
001E | DEC 2AH
0020 | MOV A, 27H
0022 | JZ 0FCH
0024 | JB 0E7H, 0F9H
0027 | DEC 27H
0029 | MOV A, 26H
002B | JZ 0FCH
002D | JB 0E7H, 0F9H
0030 | DEC 26H
0032 | MOV A, 30H
0034 | ADD A, #20H
0036 | MOV R0, A
0037 | MOV @R0, 23H
0039 | MOV 82H, 30H
003C | MOV 83H, 31H
003F | INC DPTR
0040 | MOV 08H, #03H
0043 | MOV 09H, #00H
0046 | LCALL 0395H
0049 | MOV 30H, 82H
004C | MOV 31H, 83H
004E | MOV A, #5AH

We could observe the address and get to know the situation in semaphore!

- Show and explain UART output to show the unfair version, if any, and the fair version.

A screenshot of a UART terminal window with a green background. At the top, configuration settings are displayed: a button labeled 'U', a button labeled 'No Parity', the text '8-bit UART @', and a button labeled '4800 Baud' with a dropdown arrow. Below this, the 'Rx' (Receive) section shows a buffer of 16 characters: 'Q0A1B2C3D4E5F6G7H8I9J0K1L2'. A horizontal scrollbar is positioned below the buffer. To the right of the Rx buffer is a button labeled 'Rx Reset'. The 'Tx' (Transmit) section consists of an empty text input field. To the right of the Tx field is a button labeled 'Tx Send' and a small button labeled 'i'.

Unfair would not be able to take turns in the two process!