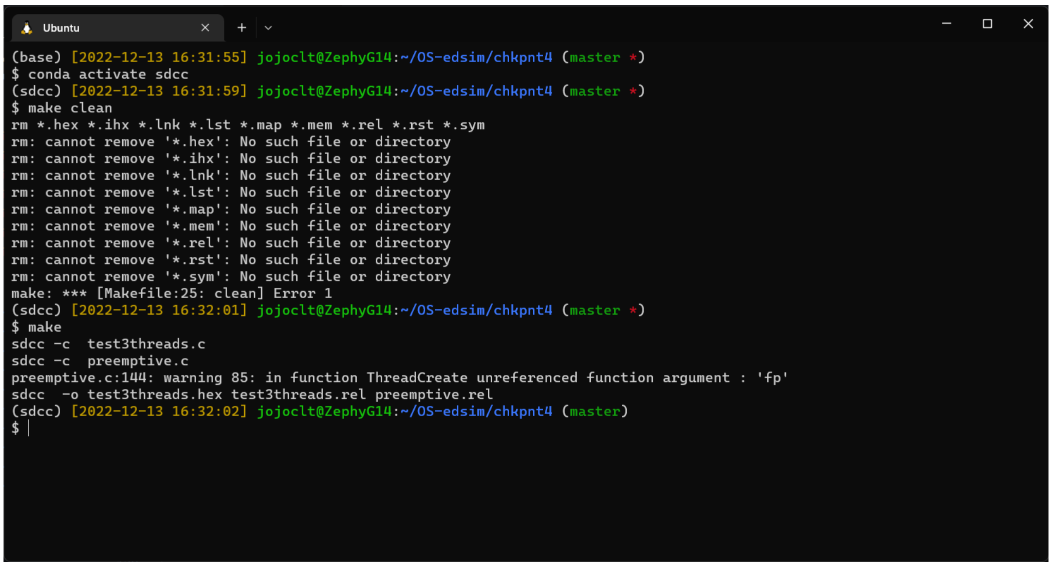
Programming Project Checkpoint#4

姚林飛 109006243

[1] Typescript for compilation

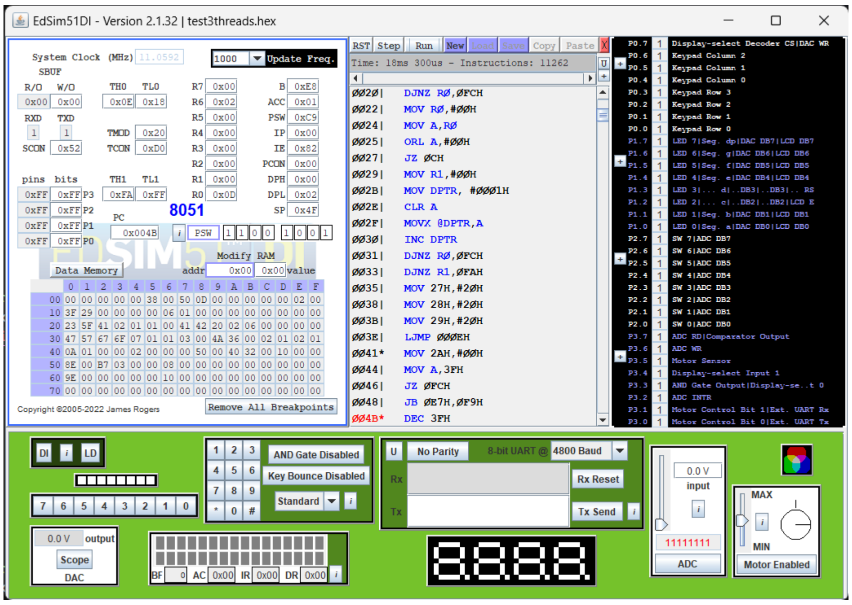


```
(base) [2022-12-13 16:31:55] jojoclt@ZephyG14:~/OS-edsim/chkpnt4 (master *)
$ conda activate sdcc
(sdcc) [2022-12-13 16:31:59] jojoclt@ZephyG14:~/OS-edsim/chkpnt4 (master *)
$ make clean
rm *.hex *.ihx *.lnk *.lst *.map *.mem *.rel *.rst *.sym
rm: cannot remove '*.hex': No such file or directory
rm: cannot remove '*.ihx': No such file or directory
rm: cannot remove '*.lnk': No such file or directory
rm: cannot remove '*.lst': No such file or directory
rm: cannot remove '*.map': No such file or directory
rm: cannot remove '*.mem': No such file or directory
rm: cannot remove '*.rel': No such file or directory
rm: cannot remove '*.rst': No such file or directory
rm: cannot remove '*.sym': No such file or directory
make: *** [Makefile:25: clean] Error 1
(sdcc) [2022-12-13 16:32:01] jojoclt@ZephyG14:~/OS-edsim/chkpnt4 (master *)
$ make
sdcc -c  test3threads.c
sdcc -c  preemptive.c
preemptive.c:144: warning 85: in function ThreadCreate unreferenced function argument : 'fp'
sdcc  -o test3threads.hex test3threads.rel preemptive.rel
(sdcc) [2022-12-13 16:32:02] jojoclt@ZephyG14:~/OS-edsim/chkpnt4 (master)
$ |
```

[2] Screenshots and explanation

Mutex - 0x3D | Full - 0x3E | Empty - 0x3F | buffer = 0x27-0x29

Producer1 running



EdSim51DI - Version 2.1.32 | test3threads.hex

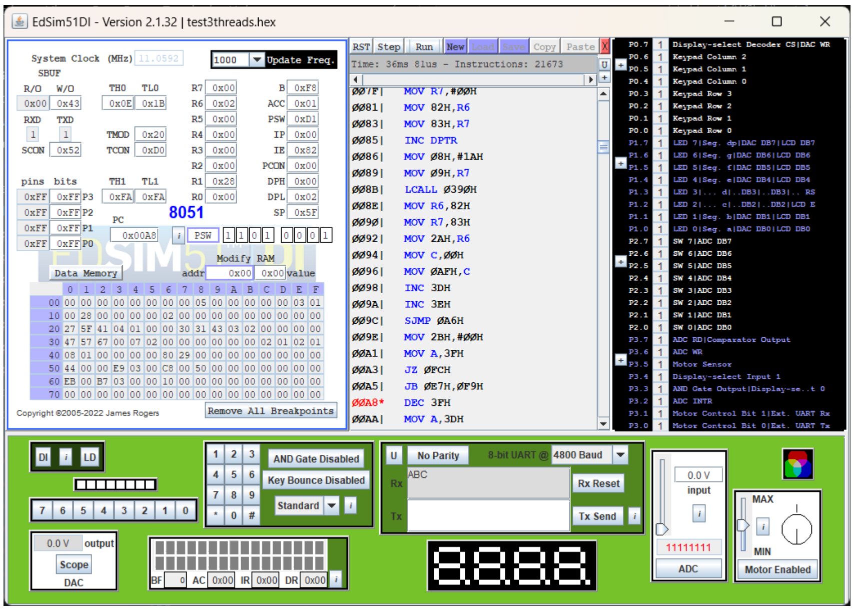
```
System Clock (MHz) 11.0592          1000  Update Freq.
SBUF
R/O   W/O     TH0   TL0     R7 0x00      B    0xE8
0x00  0x00    0x0E  0x18    R6 0x02      ACC  0x01
RXD   TXD                   R5 0x00      PSW  0xC9
1     1       TMOD  0x20    R4 0x00      IP   0x00
SCON  0x52    TCON  0xD0    R3 0x00      IE   0x82
                            R2 0x00      PCON 0x00
pins  bits    TH1   TL1     R1 0x00      DPH  0x00
0xFF  0xFF P3 0xFA  0xFF    R0 0x0D      DPL  0x02
0xFF  0xFF P2                8051        SP   0x4F
0xFF  0xFF P1   PC
0xFF  0xFF P0   0x004B    PSW 1 1 0 0  1 0 0 1

Data Memory                 Modify RAM  addr 0x00  0x00 value
    0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
00 00 00 00 00 00 38 00 50 0D 00 00 00 00 00 02 00
10 3F 29 00 00 00 00 06 01 00 00 00 00 00 00 00 00
20 23 5F 41 02 01 01 00 41 42 20 02 06 00 00 00 00
30 47 57 67 6F 07 01 01 03 00 4A 36 00 02 01 02 01
40 0A 01 00 00 02 00 00 00 50 00 40 32 00 10 00 00
50 8E 00 B7 03 00 00 08 00 00 00 00 00 00 00 00 00
60 9E 00 00 00 00 00 10 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

Time: 18ms 300us - Instructions: 11262
ØØ2Ø|   DJNZ RØ,ØFCH
ØØ22|   MOV RØ,#ØØH
ØØ24|   MOV A,RØ
ØØ25|   ORL A,#ØØH
ØØ27|   JZ ØCH
ØØ29|   MOV R1,#ØØH
ØØ2B|   MOV DPTR, #ØØØ1H
ØØ2E|   CLR A
ØØ2F|   MOVX @DPTR,A
ØØ3Ø|   INC DPTR
ØØ31|   DJNZ RØ,ØFCH
ØØ33|   DJNZ R1,ØFAH
ØØ35|   MOV 27H,#2ØH
ØØ38|   MOV 28H,#2ØH
ØØ3B|   MOV 29H,#2ØH
ØØ3E|   LJMP ØØØEH
ØØ41*   MOV 2AH,#ØØH
ØØ44|   MOV A,3FH
ØØ46|   JZ ØFCH
ØØ48|   JB ØE7H,ØF9H
ØØ4B*   DEC 3FH
```

0x27, 0x28 now have values ‘A’ and ‘B’, and 0x29 is still empty (‘ ‘). 2 Slots occupied, 1 slot empty, at 3rd iteration, mutex not lock yet, Full now equals 2 and Empty now equals 1.

Producer2 running


EdSim51DI - Version 2.1.32 | test3threads.hex

```
System Clock (MHz) 11.0592      1000  Update Freq.
SBUF
R/O   W/O     TH0   TL0    R7 0x00    B    0xF8
0x00  0x43    0x0E  0x1B   R6 0x02    ACC  0x01
RXD   TXD                  R5 0x00    PSW  0xD1
1     1       TMOD  0x20   R4 0x00    IP   0x00
SCON  0x52    TCON  0xD0   R3 0x00    IE   0x82
                           R2 0x00    PCON 0x00
pins  bits    TH1   TL1    R1 0x28    DPH  0x00
0xFF  0xFF P3 0xFA  0xFA   R0 0x00    DPL  0x02
0xFF  0xFF P2                         SP   0x5F
0xFF  0xFF P1   PC 0x00A8   PSW 1 1 0 1  0 0 0 1
0xFF  0xFF P0
```

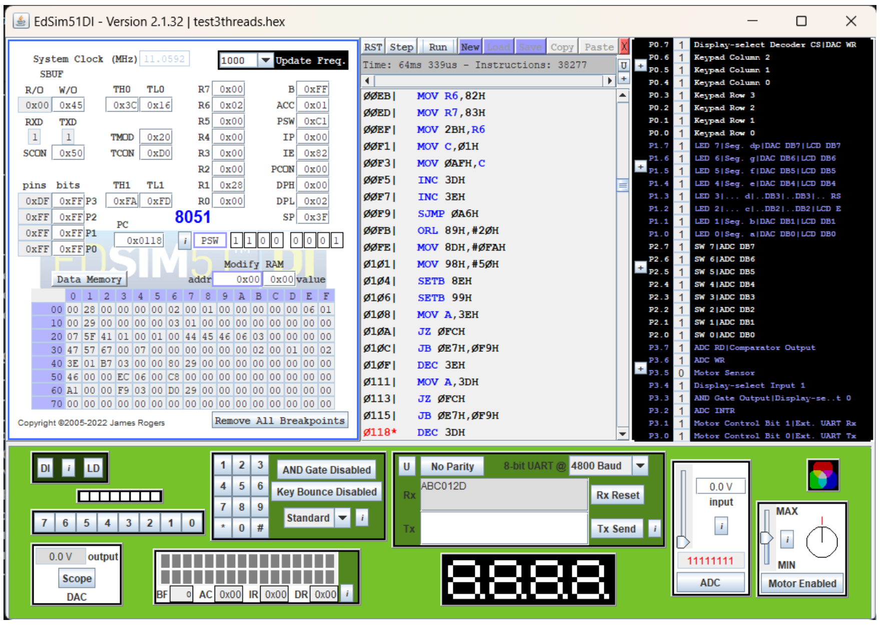
```
    0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
00 00 00 00 00 00 00 00 00 05 00 00 00 00 00 03 01
10 00 28 00 00 00 00 02 00 00 00 00 00 00 00 00 00
20 27 5F 41 04 01 00 00 30 31 43 03 02 00 00 00 00
30 47 57 67 00 07 02 00 00 00 00 00 00 02 01 02 01
40 08 01 00 00 00 00 80 29 00 00 00 00 00 00 00 00
50 44 00 00 E9 03 00 C8 00 50 00 00 00 00 00 00 00
60 EB 00 B7 03 00 00 10 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
```

```
Time: 36ms 81us - Instructions: 21673
ØØ7F|   MOV R7,#ØØH
ØØ81|   MOV 82H,R6
ØØ83|   MOV 83H,R7
ØØ85|   INC DPTR
ØØ86|   MOV Ø8H,#1AH
ØØ89|   MOV Ø9H,R7
ØØ8B|   LCALL Ø39ØH
ØØ8E|   MOV R6,82H
ØØ9Ø|   MOV R7,83H
ØØ92|   MOV 2AH,R6
ØØ94|   MOV C,ØØH
ØØ96|   MOV ØAFH,C
ØØ98|   INC 3DH
ØØ9A|   INC 3EH
ØØ9C|   SJMP ØA6H
ØØ9E|   MOV 2BH,#ØØH
ØØA1|   MOV A,3FH
ØØA3|   JZ ØFCH
ØØA5|   JB ØE7H,ØF9H
ØØA8*   DEC 3FH
ØØAA|   MOV A,3DH
```

```
No Parity   8-bit UART @ 4800 Baud
Rx ABC
```

0x27, 0x28 now have values ‘0’ and ‘1’, and 0x29 is still empty (‘ ‘). 2 Slots occupied, 1 slot empty, at 3rd iteration, mutex not lock yet, Full now equals 2 and Empty now equals 1.

Consumer running


EdSim51DI - Version 2.1.32 | test3threads.hex

```
System Clock (MHz) 11.0592      1000  Update Freq.
SBUF
R/O   W/O     TH0   TL0    R7 0x00    B    0xFF
0x00  0x45    0x3C  0x16   R6 0x02    ACC  0x01
RXD   TXD                  R5 0x00    PSW  0xC1
1     1       TMOD  0x20   R4 0x00    IP   0x00
SCON  0x50    TCON  0xD0   R3 0x00    IE   0x82
                           R2 0x00    PCON 0x00
pins  bits    TH1   TL1    R1 0x28    DPH  0x00
0xDF  0xFF P3 0xFA  0xFD   R0 0x00    DPL  0x02
0xFF  0xFF P2                         SP   0x3F
0xFF  0xFF P1   PC 0x0118   PSW 1 1 0 0  0 0 0 1
0xFF  0xFF P0
```

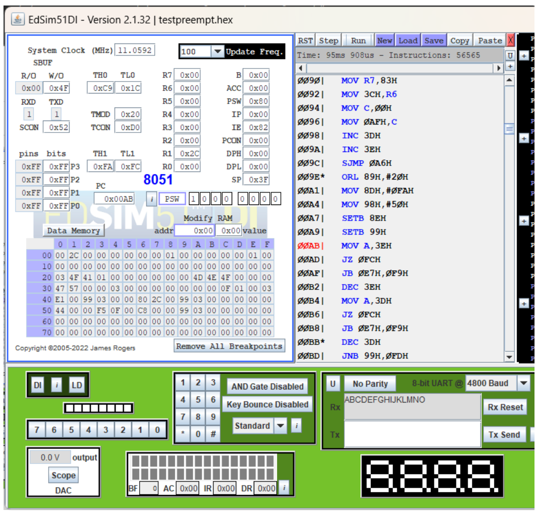
```
    0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
00 00 28 00 00 00 00 02 00 01 00 00 00 00 00 06 01
10 00 29 00 00 00 00 03 01 00 00 00 00 00 00 00 00
20 07 5F 41 01 00 01 00 44 45 46 06 03 00 00 00 00
30 47 57 67 00 07 00 00 00 00 00 00 02 00 01 00 02
40 3E 01 B7 03 00 00 80 29 00 00 00 00 00 00 00 00
50 46 00 00 EC 06 00 C8 00 00 00 00 00 00 00 00 00
60 A1 00 00 F9 03 00 D0 29 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
```

```
Time: 64ms 339us - Instructions: 38277
ØØEB|   MOV R6,82H
ØØED|   MOV R7,83H
ØØEF|   MOV 2BH,R6
ØØF1|   MOV C,Ø1H
ØØF3|   MOV ØAFH,C
ØØF5|   INC 3DH
ØØF7|   INC 3EH
ØØF9|   SJMP ØA6H
ØØFB|   ORL 89H,#2ØH
ØØFE|   MOV 8DH,#ØFAH
Ø1Ø1|   MOV 98H,#5ØH
Ø1Ø4|   SETB 8EH
Ø1Ø6|   SETB 99H
Ø1Ø8|   MOV A,3EH
Ø1ØA|   JZ ØFCH
Ø1ØC|   JB ØE7H,ØF9H
Ø1ØF|   DEC 3EH
Ø111|   MOV A,3DH
Ø113|   JZ ØFCH
Ø115|   JB ØE7H,ØF9H
Ø118*   DEC 3DH
```

```
No Parity   8-bit UART @ 4800 Baud
Rx ABC012D
```

There is a delay when using breakpoint (D) is already out, when semaphore empty reaches 3, E and F will be out, in consumer, each time semaphore full decreases and semaphore empty increases, it mean the buffer has been consumed, so it will output on the screen.

Fairness



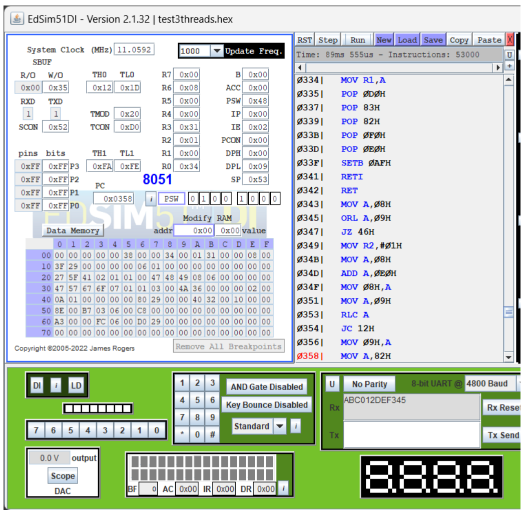
EdSim51DI - Version 2.1.32 | testpreempt.hex

```
Time: 95ms 908us - Instructions: 56565
ØØ9Ø|    MOV R7,83H
ØØ92|    MOV 3CH,R6
ØØ94|    MOV C,ØØH
ØØ96|    MOV ØAFH,C
ØØ98|    INC 3DH
ØØ9A|    INC 3EH
ØØ9C|    SJMP ØA6H
ØØ9E*    ORL 89H,#2ØH
ØØA1|    MOV 8DH,#ØFAH
ØØA4|    MOV 98H,#5ØH
ØØA7|    SETB 8EH
ØØA9|    SETB 99H
ØØAB|    MOV A,3EH
ØØAD|    JZ ØFCH
ØØAF|    JB ØE7H,ØF9H
ØØB2|    DEC 3EH
ØØB4|    MOV A,3DH
ØØB6|    JZ ØFCH
ØØB8|    JB ØE7H,ØF9H
ØØBB*    DEC 3DH
ØØBD|    JNB 99H,ØFDH
```

8-bit UART @ 4800 Baud, No Parity

```
Rx: ABCDEFGHIJKLMNO
```

UART Output of unfair version



EdSim51DI - Version 2.1.32 | test3threads.hex

```
Time: 89ms 555us - Instructions: 53000
Ø334|    MOV R1,A
Ø335|    POP ØDØH
Ø337|    POP 83H
Ø339|    POP 82H
Ø33B|    POP ØFØH
Ø33D|    POP ØEØH
Ø33F|    SETB ØAFH
Ø341|    RETI
Ø342|    RET
Ø343|    MOV A,Ø8H
Ø345|    ORL A,Ø9H
Ø347|    JZ 46H
Ø349|    MOV R2,#Ø1H
Ø34B|    MOV A,Ø8H
Ø34D|    ADD A,ØEØH
Ø34F|    MOV Ø8H,A
Ø351|    MOV A,Ø9H
Ø353|    RLC A
Ø354|    JC 12H
Ø356|    MOV Ø9H,A
Ø358|    MOV A,82H
```

8-bit UART @ 4800 Baud, No Parity

```
Rx: ABC012DEF345
```

UART Output of fair version

It can be showed that in the unfair version, because of directly using the round-robin scheduling policy, (Letter Producer before Number Producer), the Letter producer will fill in the buffer, then preempts to the Number Producer but it get blocks by the empty Semaphore, By using the fair version (P1 C P2 C) where P stands for producer, and C stands for consumer, it solves the problem of the unfair version