

**ΟΙΚΟΝΟΜΙΚΟ  
ΠΑΝΕΠΙΣΤΗΜΙΟ  
ΑΘΗΝΩΝ**



**ATHENS UNIVERSITY  
OF ECONOMICS  
AND BUSINESS**

---

## **2<sup>η</sup> Προγραμματιστική Εργασία**

**Λειτουργικά Συστήματα**

**Εαρινό εξάμηνο 2015-2016**

**Τουμανίδου Ανδρομάχη, 3040185**

## Περιγραφή υλοποίησης

Ξεκίνησα να επιλύω το πρόβλημα παραγωγού-καταναλωτή, βασιζόμενη στην περσινή εργασία που είχα κάνει με το συνεργάτη μου, την οποία όμως δεν είχαμε προλάβει να ολοκληρώσουμε και την είχαμε παραδώσει ελλιπή, χωρίς το 3ο βήμα και με αρκετές ατέλειες. Θεώρησα ότι εφόσον είχαμε γράψει μόνοι μας κάθε γραμμή κώδικα, το να αρχίσω από το μηδέν ή να σας παραπλανήσω ότι άρχισα από το μηδέν, δεν είχε κανένα απολύτως νόημα.

Διάβασα προσεκτικά τη φετινή εκφώνηση και εντόπισα τις διαφορές από την περσινή (5 παράμετροι εκτέλεσης αντί για 4, τη χωρητικότητα της ουράς τη δίνει ο χρήστης, οι παραγωγοί λαμβάνουν και το αναγνωριστικό τους και το πλήθος των ψευδοτυχαίων αριθμών ως είσοδο, διαφορετική ονοματολογία των αρχείων, διαφορετική κατανομή των συναρτήσεων σε αρχεία .c (και άρα διαφορετικές εντολές προεπεξεργασίας, μεταγλώττισης και σύνδεσης για την παραγωγή των εκτελέσιμων αρχείων), ένα μόνο κοινό αρχείο κεφαλίδων, 2 βήματα εργασίας αντί για 3).

Πρώτα βασίστηκα στο `prodcon2.c` που παραδώσαμε πέρυσι και έκανα τις απαραίτητες τροποποιήσεις και αλλαγές μεταβλητών και παραμέτρων και δομής των αρχείων και προσπάθησα να το κάνω να δουλέψει με τις φετινές απαιτήσεις. Στη συνέχεια, προσπάθησα να βρω τρόπο να εκτυπώνει με τη σειρά ο κάθε παραγωγός και ο κάθε καταναλωτής, πράγμα που δεν είχαμε καταφέρει πέρυσι. Αφού το υλοποίησα αυτό, ελπίζω με ορθό τρόπο, και έχοντας δώσει την απαραίτητη μορφή του `proco2.c`, ξεχώρισα στο αρχείο κεφαλίδων όσα χρειάζονται μόνο στο `proco2.c` από αυτά που χρειάζονται και στο `proco1.c` και στο `proco2.c`.

Μετά αφαίρεσα τα περιττά κομμάτια κώδικα, τα περιττά `mutexes` και παρήγαγα το `proco1.c`. Γνωρίζω ότι το ζητούμενο είναι να έκανα ανάποδα τη διαδικασία, αλλά, όπως προανέφερα, δεν είχε νόημα να ξεκινήσω από το μηδέν. Τέλος, προσέθεσα αναλυτικά σχόλια στον κώδικα μου σε greeklish.

Έχει γίνει `include` των απαραίτητων βιβλιοθηκών στο αρχείο κεφαλίδων και `include` του αρχείου κεφαλίδων σε κάθε αρχείο .c. Λογικά έπρεπε να βάλω να ελέγχει ο προεπεξεργαστής αν έχει γίνει ήδη `include` το αρχείο κεφαλίδων, γιατί μάλλον το εισάγει δύο φορές στα `proco1.c` και `proco2.c`. Το αρχείο με τις κοινές συναρτήσεις περιέχει μόνο τις `cb_init()`, `cb_free()`,

`cb_push_back()` και `cb_pop_front()`, που τις πήρα από το αρχείο `circular_buffer.c`. Τα αρχεία `proco1.c` και `proco2.c` περιέχουν το καθένα τη δική του συνάρτηση `main()`, τη δική του `producer()` και τη δική του `consumer()`. Στο αρχείο κεφαλίδων, έχω ξεχωρίσει κάτω-κάτω τις μεταβλητές και συναρτήσεις που χρησιμοποιούνται μόνο στο `proco2.c`.

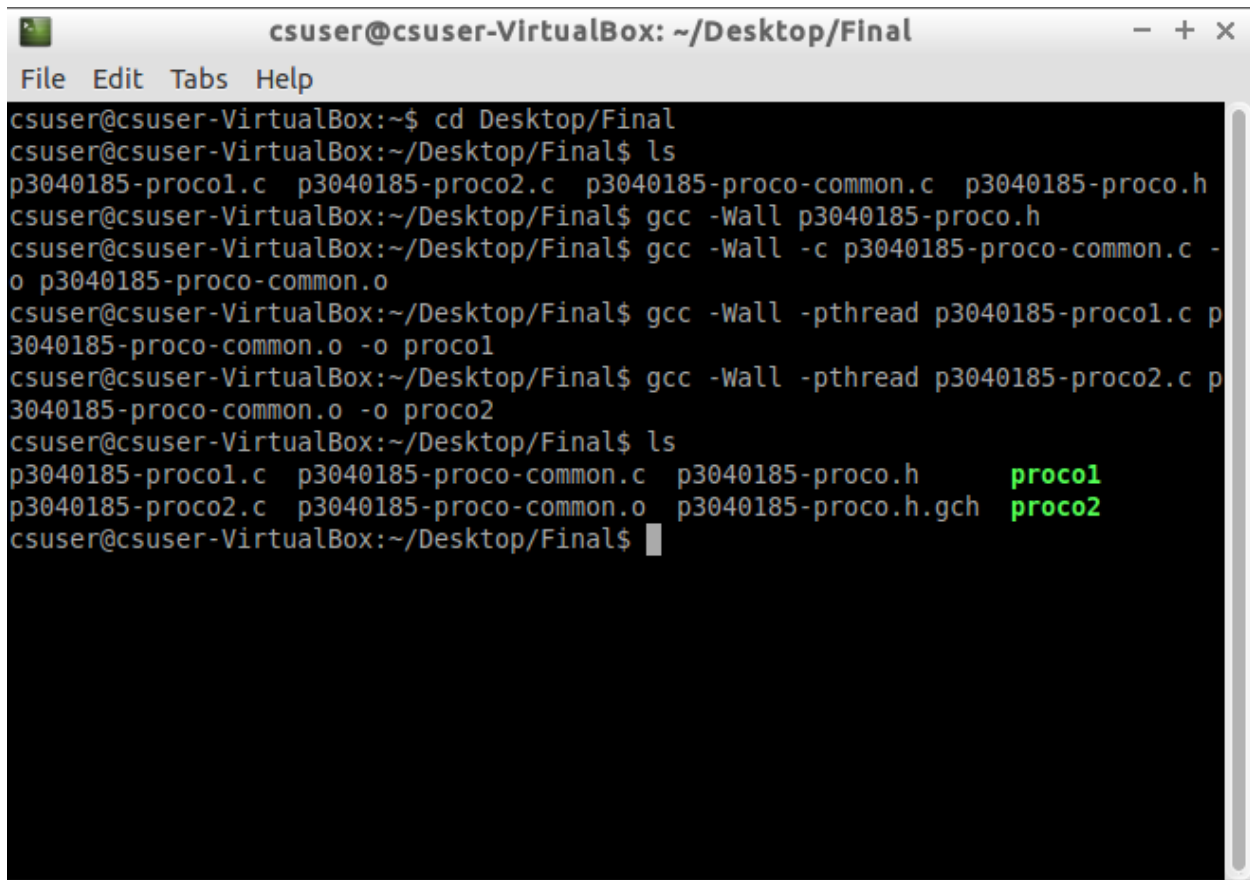
Ο κώδικας του `proco2.c` είναι ουσιαστικά ο κώδικας του `proco1.c` με τις επιπλέον απαιτούμενες δυνατότητες, οπότε ίσως θα έπρεπε να είχα χωρίσει σε μικρότερες συναρτήσεις τα κοινά τους κομμάτια, να τα συμπεριλάβω στο `proco-common.c`, και να γίνεται κλήση αυτών των μικρότερων συναρτήσεων στη `main()`, `producer()` και `consumer()` του καθενός. Έδωσα προτεραιότητα στο να παράγω τα ζητούμενα από κάθε βήμα της εργασίας και δεν ασχολήθηκα με τη σωστή επαναχρησιμοποίηση κώδικα, γιατί γινόταν πιο σύνθετη η υλοποίηση. Επίσης, έχω δηλώσει πολλές καθολικές μεταβλητές στο αρχείο κεφαλίδων, τις οποίες θα μπορούσα να βάλω στο αρχείο `proco-common.c` για να μην είναι μην είναι εμφανείς στο χρήστη, αλλά πάλι θα γινόταν πιο δύσκολο να βρω λάθη στο στάδιο της εκσφαλμάτωσης του κώδικα και έτσι το αμέλησα. Βέβαια, στην εκφώνηση αναφέρεται η τοποθέτηση των κοινών συναρτήσεων στο `proco-common.c`, όχι των κοινών μεταβλητών.

Εργάστηκα και φέτος στο Geany για τη συγγραφή του κώδικα, στην εικονική μηχανή που είχα εγκαταστήσει από πέρυσι. Αν κατάλαβα καλά, δεν την έχετε αλλάξει φέτος, οπότε δεν έκανα από την αρχή την εγκατάσταση. Με την εντολή `gcc --version` είδα ότι έχω την έκδοση 4.8.1 του μεταγλωττιστή. Υπάρχουν αναλυτικά σχόλια σχεδόν σε κάθε γραμμή εκτέλεσης, εκτός από κάποιες που είναι προφανές τι επιτελούν (`init`, `destroy`, `exit` κλπ).

Ακολουθεί η μεταγλώττιση του κώδικα σε γραμμή εντολών και στη συνέχεια η δοκιμαστική εκτέλεση των δύο προγραμμάτων με πολλές διαφορετικές παραμέτρους. Παρατίθενται τα σχετικά screenshots. Η εκτέλεση των εντολών έχει γίνει σε μια σύνοδο με τη σειρά που παρατίθενται, απλώς πριν την επόμενη εκτέλεση προγράμματος κάνω `clear`, εκτός από τις μεταγλωττίσεις στην αρχή και τις εκτελέσεις που βγάζουν μηνύματα λάθους που τα έχω ομαδοποιήσει σε ίδια screenshots. Παράλληλα με κάθε εκτέλεση που δε βγάζει σφάλμα, παραθέτω και τα περιεχόμενα των εκάστοτε δύο αρχείων `.txt` που προκύπτουν.

## Μεταγλώττιση

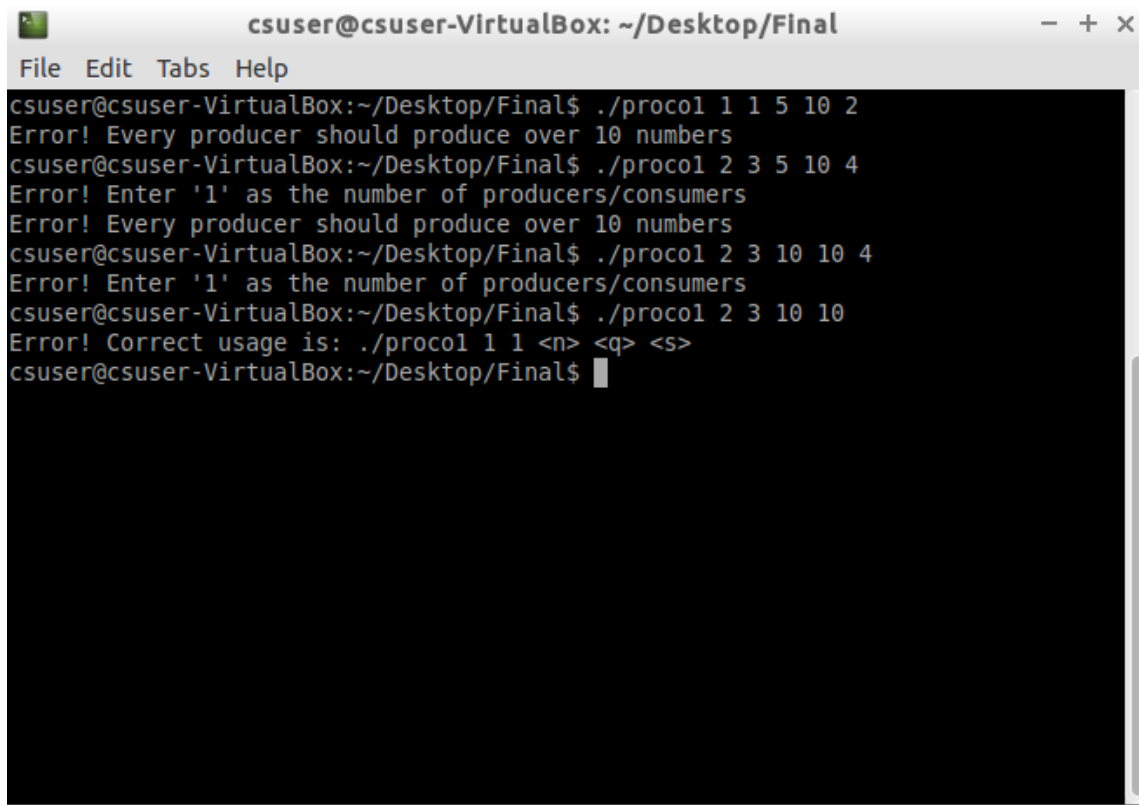
- Μπαίνω στο φάκελο που έχω αποθηκεύσει τα τελικά αρχεία της εργασίας
- Δείχνω το περιεχόμενο του φακέλου
- Προεπεξεργασία και μεταγλώττιση στο αρχείο κεφαλίδων
- Προεπεξεργασία και μεταγλώττιση στο αρχείο με τις κοινές συναρτήσεις των δύο βημάτων, χωρίς όμως να γίνει σύνδεση από τον linker
- Προεπεξεργασία και μεταγλώττιση (με επιλογή `-pthread`) στα `p3040185-proco1.c` και `p3040185-proco2.c`, συνδέοντάς τα με το `p3040185-proco-common.o` (που προέκυψε από την προηγούμενη μεταγλώττιση). Αποτέλεσμα είναι τα εκτελέσιμα `proco1` και `proco2`.
- Δείχνω τα νέα περιεχόμενα του φακέλου, μετά την εκτέλεση των παραπάνω εντολών



```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~$ cd Desktop/Final
csuser@csuser-VirtualBox:~/Desktop/Final$ ls
p3040185-proco1.c p3040185-proco2.c p3040185-proco-common.c p3040185-proco.h
csuser@csuser-VirtualBox:~/Desktop/Final$ gcc -Wall p3040185-proco.h
csuser@csuser-VirtualBox:~/Desktop/Final$ gcc -Wall -c p3040185-proco-common.c -
o p3040185-proco-common.o
csuser@csuser-VirtualBox:~/Desktop/Final$ gcc -Wall -pthread p3040185-proco1.c p
3040185-proco-common.o -o proco1
csuser@csuser-VirtualBox:~/Desktop/Final$ gcc -Wall -pthread p3040185-proco2.c p
3040185-proco-common.o -o proco2
csuser@csuser-VirtualBox:~/Desktop/Final$ ls
p3040185-proco1.c p3040185-proco-common.c p3040185-proco.h      proco1
p3040185-proco2.c p3040185-proco-common.o p3040185-proco.h.gch  proco2
csuser@csuser-VirtualBox:~/Desktop/Final$
```

### Οριακές περιπτώσεις για το proco1

- ./proco1 1 1 5 10 2
- ./proco1 2 3 5 10 4
- ./proco1 2 3 10 10 4
- ./proco1 2 3 10 10



```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco1 1 1 5 10 2
Error! Every producer should produce over 10 numbers
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco1 2 3 5 10 4
Error! Enter '1' as the number of producers/consumers
Error! Every producer should produce over 10 numbers
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco1 2 3 10 10 4
Error! Enter '1' as the number of producers/consumers
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco1 2 3 10 10
Error! Correct usage is: ./proco1 1 1 <n> <q> <s>
csuser@csuser-VirtualBox:~/Desktop/Final$
```

Διαδοχικές εκτελέσεις του proco1 με διαφορετικές παραμέτρους

- ./proco1 1 1 11 10 2

The screenshot displays a terminal window and two text editors. The terminal window, titled 'csuser@csuser-VirtualBox: ~/Desktop/Final', shows the command './proco1 1 1 11 10 2' being executed. The output consists of two lines: 'Producer 1: 255, 215, 78, 19, 99, 6, 156, 224, 10, 242, 142' and 'Consumer 1: 255, 215, 78, 19, 99, 6, 156, 224, 10, 242, 142'. Below the terminal, there are two text editors. The left editor, titled 'consumers\_out.txt', contains a list of consumer data: 'Consumer 1, 255', 'Consumer 1, 215', 'Consumer 1, 78', 'Consumer 1, 19', 'Consumer 1, 99', 'Consumer 1, 6', 'Consumer 1, 156', 'Consumer 1, 224', 'Consumer 1, 10', 'Consumer 1, 242', and 'Consumer 1, 142'. The right editor, titled 'producers\_in.txt', contains a list of producer data: 'Producer 1, 255', 'Producer 1, 215', 'Producer 1, 78', 'Producer 1, 19', 'Producer 1, 99', 'Producer 1, 6', 'Producer 1, 156', 'Producer 1, 224', 'Producer 1, 10', 'Producer 1, 242', and 'Producer 1, 142'.

```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco1 1 1 11 10 2
Producer 1: 255, 215, 78, 19, 99, 6, 156, 224, 10, 242, 142
Consumer 1: 255, 215, 78, 19, 99, 6, 156, 224, 10, 242, 142
csuser@csuser-VirtualBox:~/Desktop/Final$
```

consumers\_out.txt - + x  
File Edit Search Options Help  
Consumer 1, 255  
Consumer 1, 215  
Consumer 1, 78  
Consumer 1, 19  
Consumer 1, 99  
Consumer 1, 6  
Consumer 1, 156  
Consumer 1, 224  
Consumer 1, 10  
Consumer 1, 242  
Consumer 1, 142

producers\_in.txt - + x  
File Edit Search Options Help  
Producer 1, 255  
Producer 1, 215  
Producer 1, 78  
Producer 1, 19  
Producer 1, 99  
Producer 1, 6  
Producer 1, 156  
Producer 1, 224  
Producer 1, 10  
Producer 1, 242  
Producer 1, 142

- ./proco1 1 20 10 3

```

csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco1 1 1 20 10 3
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 125, 180, 72, 70, 229, 76, 227, 120, 140, 92, 50, 254, 35, 237, 201,
125, 1, 85, 160, 109
Consumer 1: 125, 180, 72, 70, 229, 76, 227, 120, 140, 92, 50, 254, 35, 237, 201,
125, 1, 85, 160, 109
csuser@csuser-VirtualBox:~/Desktop/Final$

```

consumers\_out.txt
File Edit Search Options Help
Consumer 1, 125
Consumer 1, 180
Consumer 1, 72
Consumer 1, 70
Consumer 1, 229
Consumer 1, 76
Consumer 1, 227
Consumer 1, 120
Consumer 1, 140
Consumer 1, 92
Consumer 1, 50
Consumer 1, 254
Consumer 1, 35
Consumer 1, 237
Consumer 1, 201
Consumer 1, 125
Consumer 1, 1
Consumer 1, 85
Consumer 1, 160
Consumer 1, 109

producers\_in.txt
File Edit Search Options Help
Producer 1, 125
Producer 1, 180
Producer 1, 72
Producer 1, 70
Producer 1, 229
Producer 1, 76
Producer 1, 227
Producer 1, 120
Producer 1, 140
Producer 1, 92
Producer 1, 50
Producer 1, 254
Producer 1, 35
Producer 1, 237
Producer 1, 201
Producer 1, 125
Producer 1, 1
Producer 1, 85
Producer 1, 160
Producer 1, 109

- ./proco1 1 1 10 20 5

The screenshot displays a terminal window titled 'csuser@csuser-VirtualBox: ~/Desktop/Final' with a menu bar (File, Edit, Tabs, Help). The terminal shows the execution of the command './proco1 1 1 10 20 5'. The output indicates that files './consumers\_out.txt' and './producers\_in.txt' existed and were deleted. It then lists the initial coordinates for 'Producer 1' and 'Consumer 1' as (120, 108, 60, 172, 233, 217, 111, 169, 146, 49). Below the terminal, two text editor windows are open. The left window, titled 'producers\_in.txt', contains a list of the producer's initial coordinates. The right window, titled 'consumers\_out.txt', contains a list of the consumer's initial coordinates. Both lists are identical and contain ten entries.

```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco1 1 1 10 20 5
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 120, 108, 60, 172, 233, 217, 111, 169, 146, 49
Consumer 1: 120, 108, 60, 172, 233, 217, 111, 169, 146, 49
csuser@csuser-VirtualBox:~/Desktop/Final$
```

**producers\_in.txt**

```
Producer 1, 120
Producer 1, 108
Producer 1, 60
Producer 1, 172
Producer 1, 233
Producer 1, 217
Producer 1, 111
Producer 1, 169
Producer 1, 146
Producer 1, 49
```

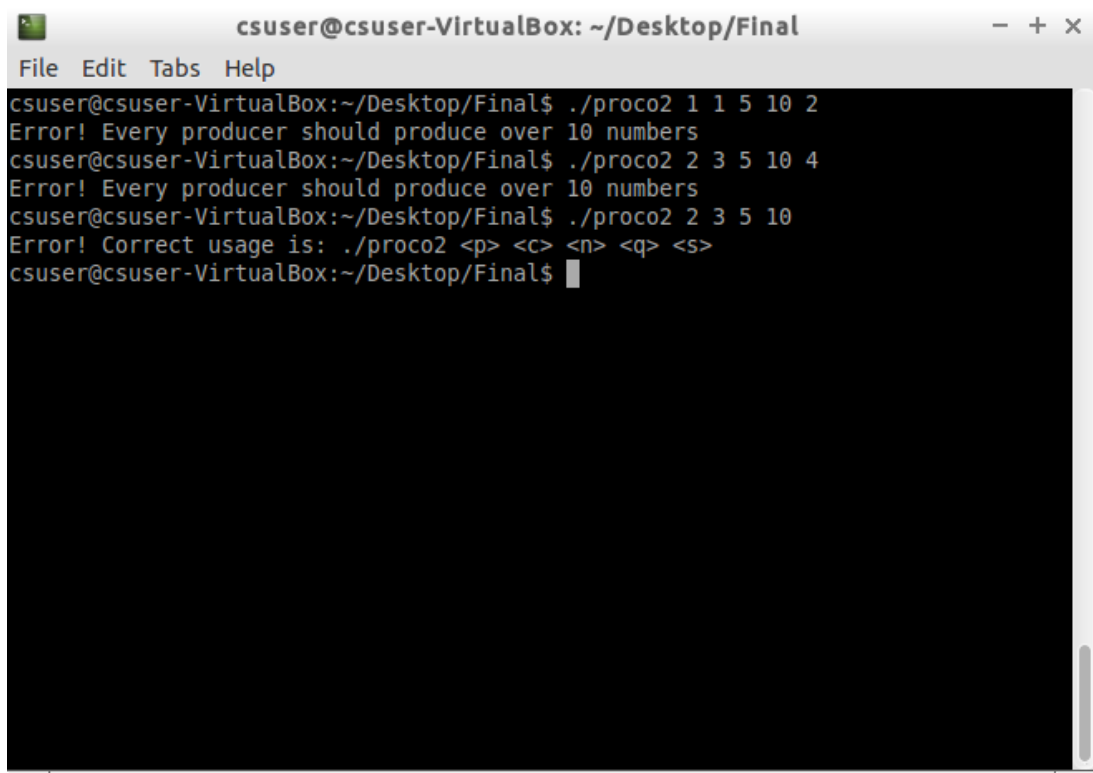
**consumers\_out.txt**

```
Consumer 1, 120
Consumer 1, 108
Consumer 1, 60
Consumer 1, 172
Consumer 1, 233
Consumer 1, 217
Consumer 1, 111
Consumer 1, 169
Consumer 1, 146
Consumer 1, 49
```



### Οριακές περιπτώσεις για το proco2

- `./proco2 1 1 5 10 2`
- `./proco2 2 3 10 10 4`
- `./proco2 2 3 5 10`



```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 1 1 5 10 2
Error! Every producer should produce over 10 numbers
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 2 3 5 10 4
Error! Every producer should produce over 10 numbers
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 2 3 5 10
Error! Correct usage is: ./proco2 <p> <c> <n> <q> <s>
csuser@csuser-VirtualBox:~/Desktop/Final$
```

Διαδοχικές εκτελέσεις του proco1 με διαφορετικές παραμέτρους

- ./proco2 1 1 11 10 2

The image shows a terminal window titled 'csuser@csuser-VirtualBox: ~/Desktop/Final' with a menu bar (File, Edit, Tabs, Help). The terminal output shows the execution of './proco2 1 1 11 10 2', which results in deleting 'consumers\_out.txt' and 'producers\_in.txt', and then printing the same data for both Producer 1 and Consumer 1. Below the terminal, two text files are open side-by-side. The left file, 'producers\_in.txt', contains a list of 12 values for 'Producer 1'. The right file, 'consumers\_out.txt', contains a list of 12 values for 'Consumer 1'. Both lists are identical: 255, 215, 78, 19, 99, 6, 156, 224, 10, 242, 142.

```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 1 1 11 10 2
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 255, 215, 78, 19, 99, 6, 156, 224, 10, 242, 142
Consumer 1: 255, 215, 78, 19, 99, 6, 156, 224, 10, 242, 142
csuser@csuser-VirtualBox:~/Desktop/Final$
```

**producers\_in.txt**

```
File Edit Search Options Help
Producer 1, 255
Producer 1, 215
Producer 1, 78
Producer 1, 19
Producer 1, 99
Producer 1, 6
Producer 1, 156
Producer 1, 224
Producer 1, 10
Producer 1, 242
Producer 1, 142
```

**consumers\_out.txt**

```
File Edit Search Options Help
Consumer 1, 255
Consumer 1, 215
Consumer 1, 78
Consumer 1, 19
Consumer 1, 99
Consumer 1, 6
Consumer 1, 156
Consumer 1, 224
Consumer 1, 10
Consumer 1, 242
Consumer 1, 142
```

- ./proco2 1 20 10 3

The screenshot shows a terminal window titled 'csuser@csuser-VirtualBox: ~/Desktop/Final'. The terminal output is as follows:

```
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 1 1 20 10 3
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 125, 180, 72, 70, 229, 76, 227, 120, 140, 92, 50, 254, 35, 237, 201,
125, 1, 85, 160, 109
Consumer 1: 125, 180, 72, 70, 229, 76, 227, 120, 140, 92, 50, 254, 35, 237, 201,
125, 1, 85, 160, 109
csuser@csuser-VirtualBox:~/Desktop/Final$
```

Below the terminal are two text files:

**producers\_in.txt**

```

Producer 1, 125
Producer 1, 180
Producer 1, 72
Producer 1, 70
Producer 1, 229
Producer 1, 76
Producer 1, 227
Producer 1, 120
Producer 1, 140
Producer 1, 92
Producer 1, 50
Producer 1, 254
Producer 1, 35
Producer 1, 237
Producer 1, 201
Producer 1, 125
Producer 1, 1
Producer 1, 85
Producer 1, 160
Producer 1, 109

```

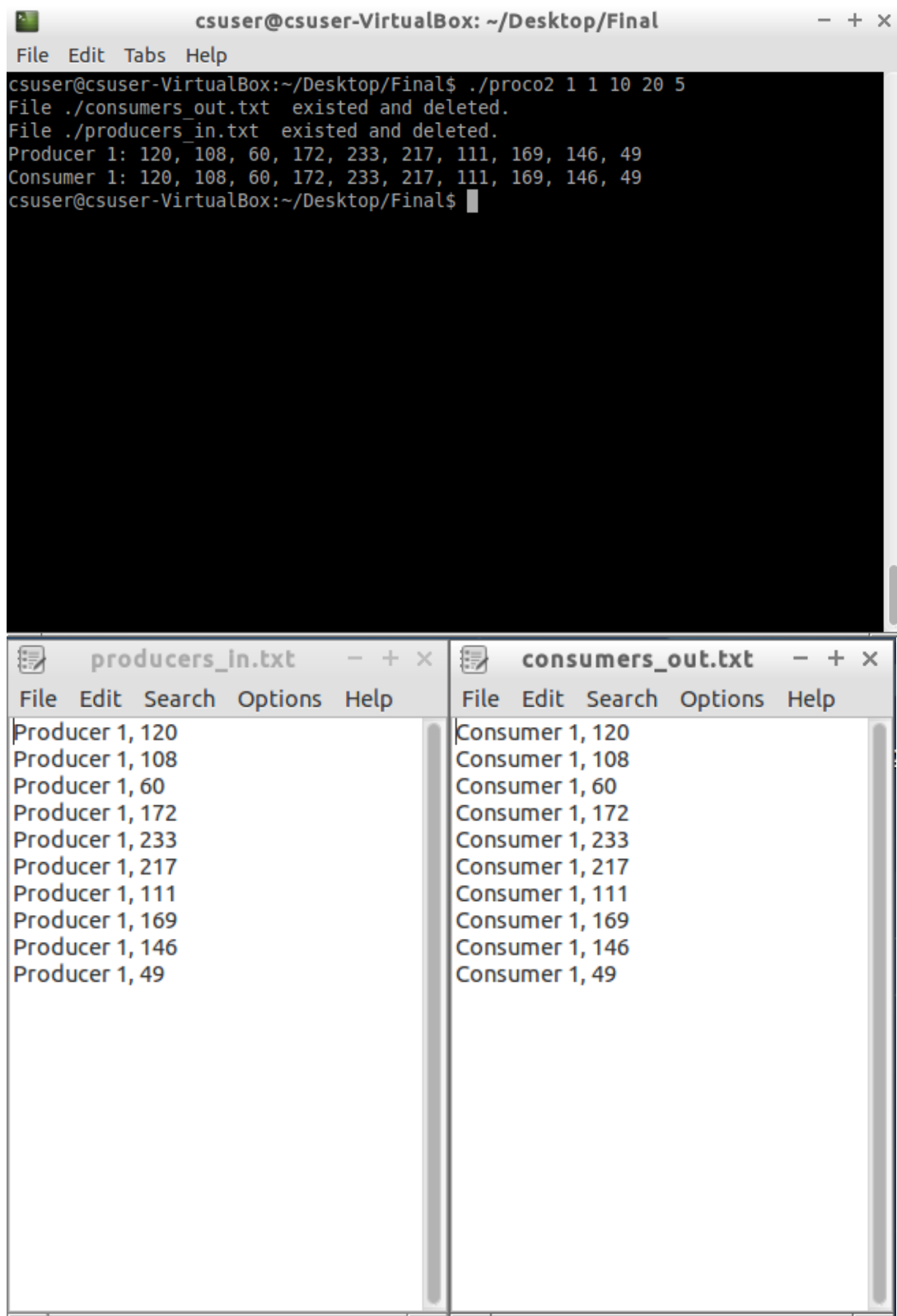
**consumers\_out.txt**

```

Consumer 1, 125
Consumer 1, 180
Consumer 1, 72
Consumer 1, 70
Consumer 1, 229
Consumer 1, 76
Consumer 1, 227
Consumer 1, 120
Consumer 1, 140
Consumer 1, 92
Consumer 1, 50
Consumer 1, 254
Consumer 1, 35
Consumer 1, 237
Consumer 1, 201
Consumer 1, 125
Consumer 1, 1
Consumer 1, 85
Consumer 1, 160
Consumer 1, 109

```

- `./proco2 1 1 10 20 5`



The screenshot shows a terminal window titled `csuser@csuser-VirtualBox: ~/Desktop/Final` with a menu bar `File Edit Tabs Help`. The terminal output is as follows:

```
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 1 1 10 20 5
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 120, 108, 60, 172, 233, 217, 111, 169, 146, 49
Consumer 1: 120, 108, 60, 172, 233, 217, 111, 169, 146, 49
csuser@csuser-VirtualBox:~/Desktop/Final$
```

Below the terminal are two text editors. The left editor, titled `producers_in.txt`, contains the following text:

```
Producer 1, 120
Producer 1, 108
Producer 1, 60
Producer 1, 172
Producer 1, 233
Producer 1, 217
Producer 1, 111
Producer 1, 169
Producer 1, 146
Producer 1, 49
```

The right editor, titled `consumers_out.txt`, contains the following text:

```
Consumer 1, 120
Consumer 1, 108
Consumer 1, 60
Consumer 1, 172
Consumer 1, 233
Consumer 1, 217
Consumer 1, 111
Consumer 1, 169
Consumer 1, 146
Consumer 1, 49
```

- ./proco2 2 3 5 10 4

The screenshot shows a terminal window titled 'csuser@csuser-VirtualBox: ~/Desktop/Final' with a menu bar (File, Edit, Tabs, Help). The terminal output is as follows:

```
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 2 3 10 10 4
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 251, 144, 66, 121, 103, 147, 41, 16, 15, 199
Producer 2: 242, 1, 43, 70, 111, 173, 66, 114, 26, 113
Consumer 1: 251, 1, 121, 111, 41, 114, 199
Consumer 2: 242, 66, 70, 147, 66, 15, 113
Consumer 3: 144, 43, 103, 173, 16, 26
csuser@csuser-VirtualBox:~/Desktop/Final$
```

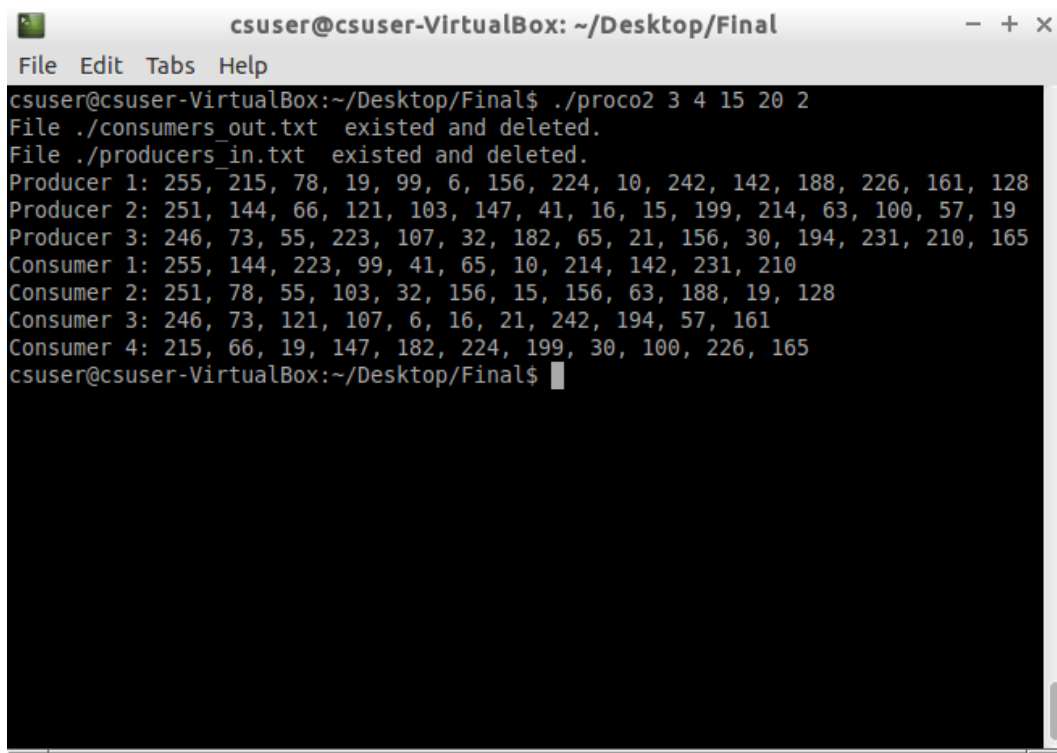
Below the terminal are two text editors. The left editor, titled 'producers\_in.txt', contains the following text:

```
Producer 1, 251
Producer 2, 242
Producer 1, 144
Producer 2, 1
Producer 1, 66
Producer 2, 43
Producer 1, 121
Producer 2, 70
Producer 1, 103
Producer 2, 111
Producer 1, 147
Producer 2, 173
Producer 1, 41
Producer 2, 66
Producer 1, 16
Producer 2, 114
Producer 1, 15
Producer 2, 26
Producer 1, 199
Producer 2, 113
```

The right editor, titled 'consumers\_out.txt', contains the following text:

```
Consumer 1, 251
Consumer 2, 242
Consumer 3, 144
Consumer 1, 1
Consumer 2, 66
Consumer 3, 43
Consumer 1, 121
Consumer 2, 70
Consumer 3, 103
Consumer 1, 111
Consumer 2, 147
Consumer 3, 173
Consumer 1, 41
Consumer 2, 66
Consumer 3, 16
Consumer 1, 114
Consumer 2, 15
Consumer 3, 26
Consumer 1, 199
Consumer 2, 113
```

- `./proco2 3 4 15 20 2`

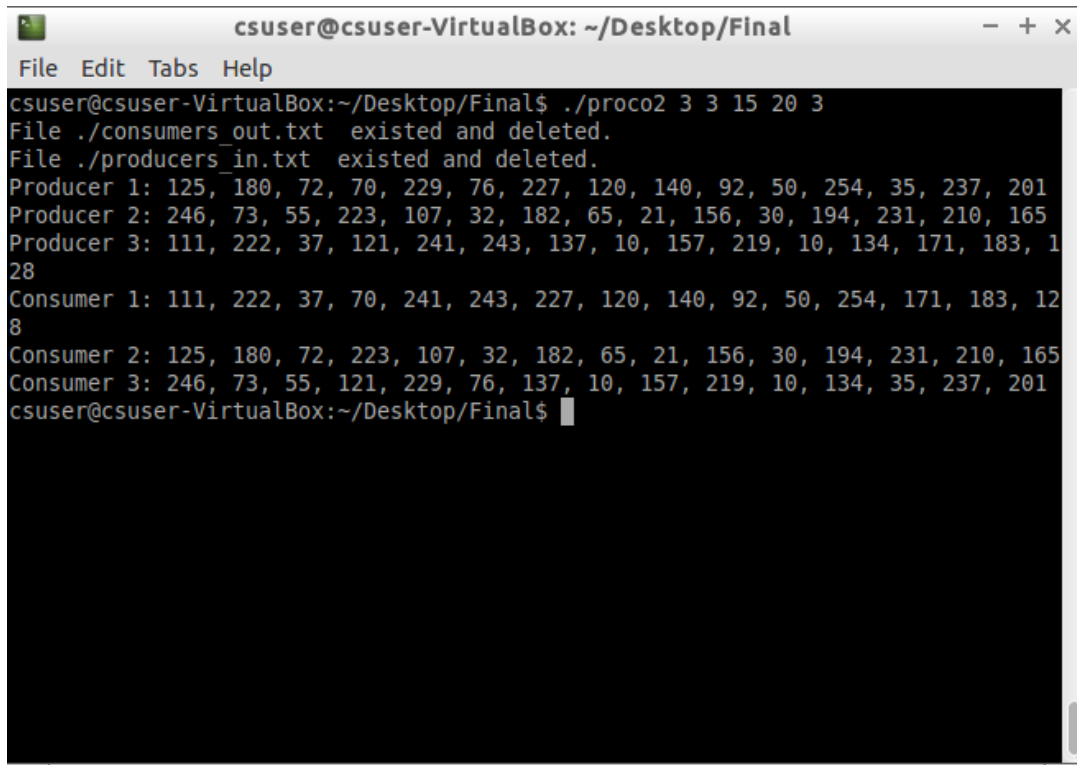


The screenshot shows a terminal window titled "csuser@csuser-VirtualBox: ~/Desktop/Final". The window has a menu bar with "File", "Edit", "Tabs", and "Help". The terminal content shows the command `./proco2 3 4 15 20 2` being executed. The output indicates that files `./consumers_out.txt` and `./producers_in.txt` existed and were deleted. It then lists data for three producers and four consumers, each with a set of 15 integers. The terminal ends with the prompt `csuser@csuser-VirtualBox:~/Desktop/Final$`.

```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 3 4 15 20 2
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 255, 215, 78, 19, 99, 6, 156, 224, 10, 242, 142, 188, 226, 161, 128
Producer 2: 251, 144, 66, 121, 103, 147, 41, 16, 15, 199, 214, 63, 100, 57, 19
Producer 3: 246, 73, 55, 223, 107, 32, 182, 65, 21, 156, 30, 194, 231, 210, 165
Consumer 1: 255, 144, 223, 99, 41, 65, 10, 214, 142, 231, 210
Consumer 2: 251, 78, 55, 103, 32, 156, 15, 156, 63, 188, 19, 128
Consumer 3: 246, 73, 121, 107, 6, 16, 21, 242, 194, 57, 161
Consumer 4: 215, 66, 19, 147, 182, 224, 199, 30, 100, 226, 165
csuser@csuser-VirtualBox:~/Desktop/Final$
```

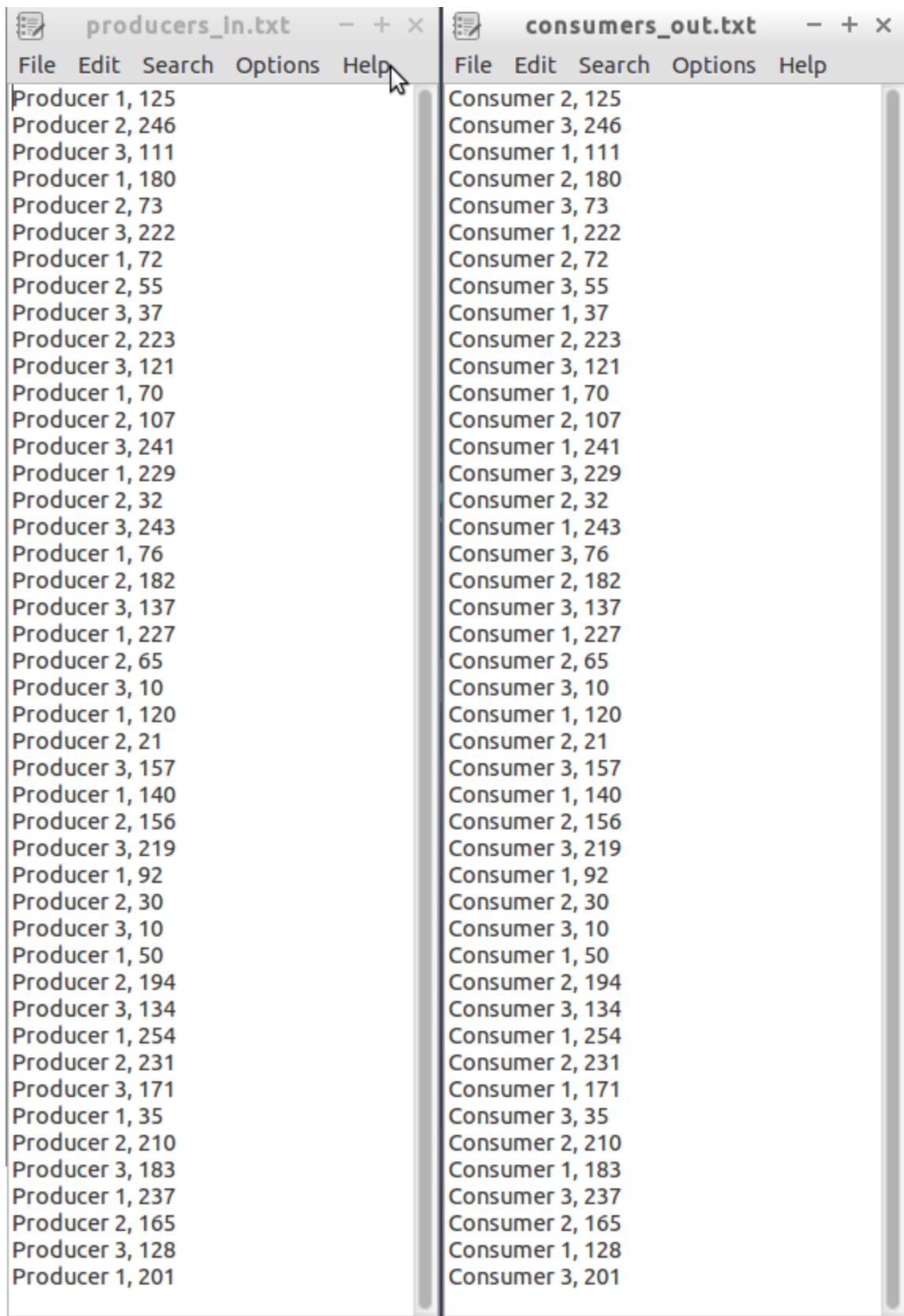
producers_in.txt	consumers_out.txt
File Edit Search Options Help	File Edit Search Options Help
Producer 1, 255	Consumer 1, 255
Producer 2, 251	Consumer 2, 251
Producer 3, 246	Consumer 3, 246
Producer 1, 215	Consumer 4, 215
Producer 2, 144	Consumer 1, 144
Producer 3, 73	Consumer 3, 73
Producer 1, 78	Consumer 2, 78
Producer 2, 66	Consumer 4, 66
Producer 3, 55	Consumer 2, 55
Producer 2, 121	Consumer 3, 121
Producer 3, 223	Consumer 1, 223
Producer 1, 19	Consumer 4, 19
Producer 2, 103	Consumer 2, 103
Producer 3, 107	Consumer 3, 107
Producer 1, 99	Consumer 1, 99
Producer 2, 147	Consumer 4, 147
Producer 3, 32	Consumer 2, 32
Producer 1, 6	Consumer 3, 6
Producer 2, 41	Consumer 1, 41
Producer 3, 182	Consumer 4, 182
Producer 1, 156	Consumer 2, 156
Producer 2, 16	Consumer 3, 16
Producer 3, 65	Consumer 1, 65
Producer 1, 224	Consumer 4, 224
Producer 2, 15	Consumer 2, 15
Producer 3, 21	Consumer 3, 21
Producer 1, 10	Consumer 1, 10
Producer 2, 199	Consumer 4, 199
Producer 3, 156	Consumer 2, 156
Producer 1, 242	Consumer 3, 242
Producer 2, 214	Consumer 1, 214
Producer 3, 30	Consumer 4, 30
Producer 2, 63	Consumer 2, 63
Producer 1, 142	Consumer 1, 142
Producer 3, 194	Consumer 3, 194
Producer 2, 100	Consumer 4, 100
Producer 1, 188	Consumer 2, 188
Producer 3, 231	Consumer 1, 231
Producer 2, 57	Consumer 3, 57
Producer 1, 226	Consumer 4, 226
Producer 2, 19	Consumer 2, 19
Producer 3, 210	Consumer 1, 210
Producer 1, 161	Consumer 3, 161
Producer 3, 165	Consumer 4, 165
Producer 1, 128	Consumer 2, 128

- `./proco2 3 3 15 20 3`

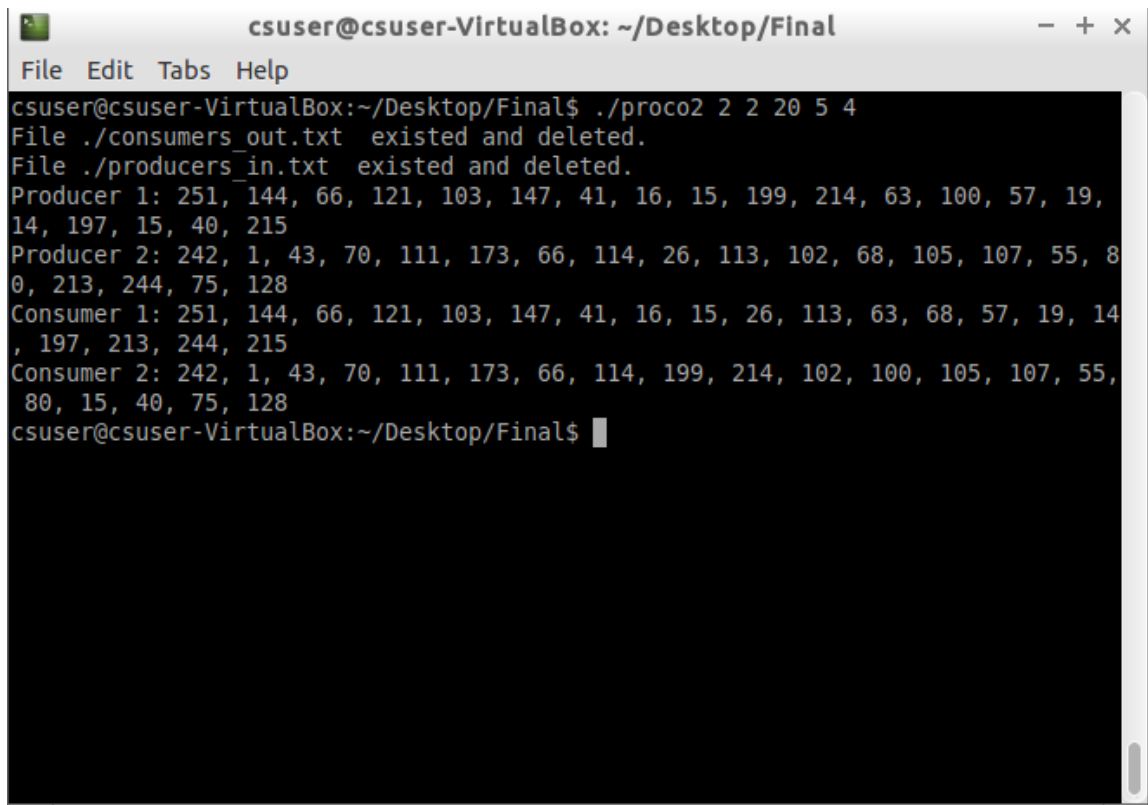


```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 3 3 15 20 3
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 125, 180, 72, 70, 229, 76, 227, 120, 140, 92, 50, 254, 35, 237, 201
Producer 2: 246, 73, 55, 223, 107, 32, 182, 65, 21, 156, 30, 194, 231, 210, 165
Producer 3: 111, 222, 37, 121, 241, 243, 137, 10, 157, 219, 10, 134, 171, 183, 128
Consumer 1: 111, 222, 37, 70, 241, 243, 227, 120, 140, 92, 50, 254, 171, 183, 128
Consumer 2: 125, 180, 72, 223, 107, 32, 182, 65, 21, 156, 30, 194, 231, 210, 165
Consumer 3: 246, 73, 55, 121, 229, 76, 137, 10, 157, 219, 10, 134, 35, 237, 201
csuser@csuser-VirtualBox:~/Desktop/Final$
```





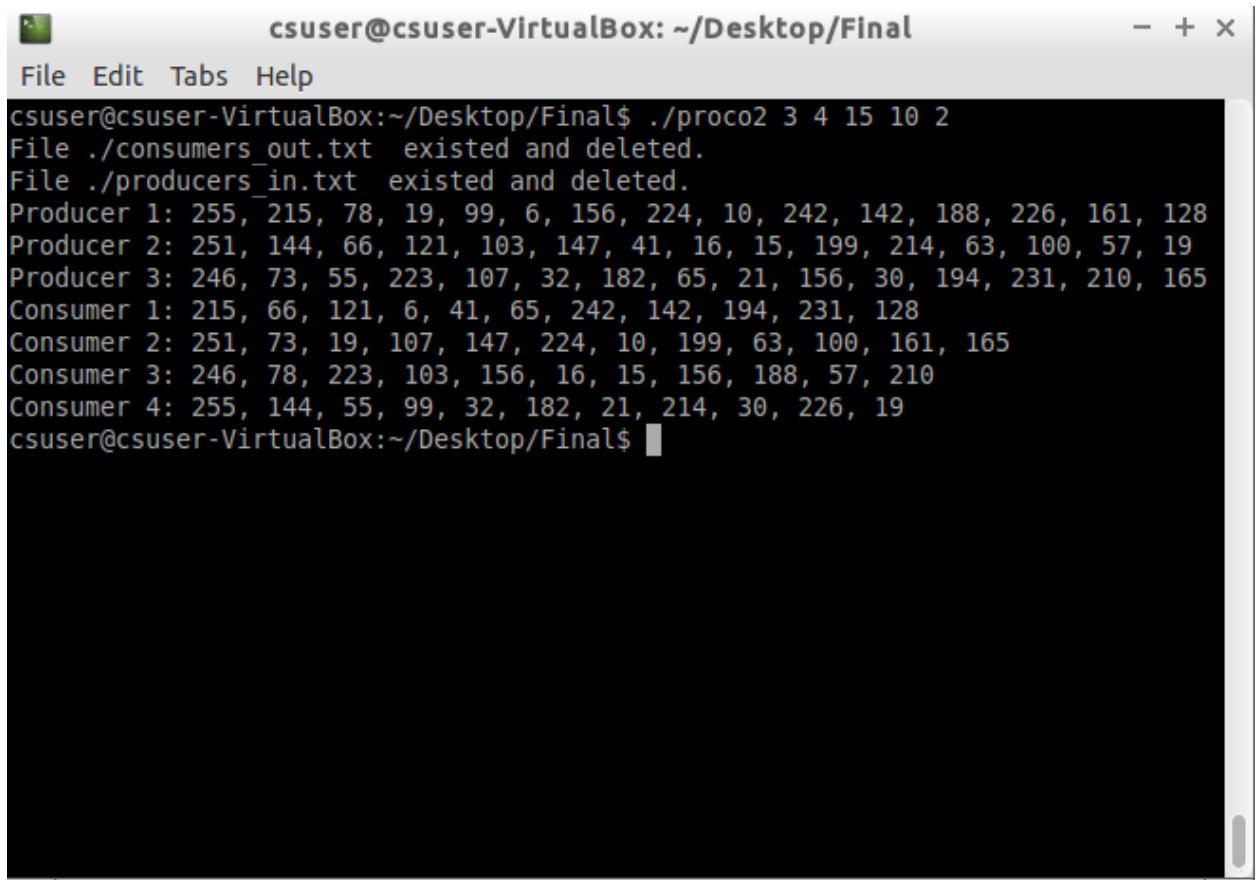
- ./proco2 2 2 20 5 4



```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 2 2 20 5 4
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 251, 144, 66, 121, 103, 147, 41, 16, 15, 199, 214, 63, 100, 57, 19,
14, 197, 15, 40, 215
Producer 2: 242, 1, 43, 70, 111, 173, 66, 114, 26, 113, 102, 68, 105, 107, 55, 8
0, 213, 244, 75, 128
Consumer 1: 251, 144, 66, 121, 103, 147, 41, 16, 15, 26, 113, 63, 68, 57, 19, 14
, 197, 213, 244, 215
Consumer 2: 242, 1, 43, 70, 111, 173, 66, 114, 199, 214, 102, 100, 105, 107, 55,
80, 15, 40, 75, 128
csuser@csuser-VirtualBox:~/Desktop/Final$
```

producers_in.txt	consumers_out.txt
File Edit Search Options Help	File Edit Search Options Help
Producer 1, 251	Consumer 1, 251
Producer 2, 242	Consumer 2, 242
Producer 1, 144	Consumer 1, 144
Producer 2, 1	Consumer 2, 1
Producer 1, 66	Consumer 1, 66
Producer 2, 43	Consumer 2, 43
Producer 1, 121	Consumer 1, 121
Producer 2, 70	Consumer 2, 70
Producer 1, 103	Consumer 1, 103
Producer 2, 111	Consumer 2, 111
Producer 1, 147	Consumer 1, 147
Producer 2, 173	Consumer 2, 173
Producer 1, 41	Consumer 1, 41
Producer 2, 66	Consumer 2, 66
Producer 1, 16	Consumer 1, 16
Producer 2, 114	Consumer 2, 114
Producer 1, 15	Consumer 1, 15
Producer 1, 199	Consumer 2, 199
Producer 2, 26	Consumer 1, 26
Producer 1, 214	Consumer 2, 214
Producer 2, 113	Consumer 1, 113
Producer 2, 102	Consumer 2, 102
Producer 1, 63	Consumer 1, 63
Producer 1, 100	Consumer 2, 100
Producer 2, 68	Consumer 1, 68
Producer 2, 105	Consumer 2, 105
Producer 1, 57	Consumer 1, 57
Producer 2, 107	Consumer 2, 107
Producer 1, 19	Consumer 1, 19
Producer 2, 55	Consumer 2, 55
Producer 1, 14	Consumer 1, 14
Producer 2, 80	Consumer 2, 80
Producer 1, 197	Consumer 1, 197
Producer 1, 15	Consumer 2, 15
Producer 2, 213	Consumer 1, 213
Producer 1, 40	Consumer 2, 40
Producer 2, 244	Consumer 1, 244
Producer 2, 75	Consumer 2, 75
Producer 1, 215	Consumer 1, 215
Producer 2, 128	Consumer 2, 128

- `./proco2 3 4 15 10 2`

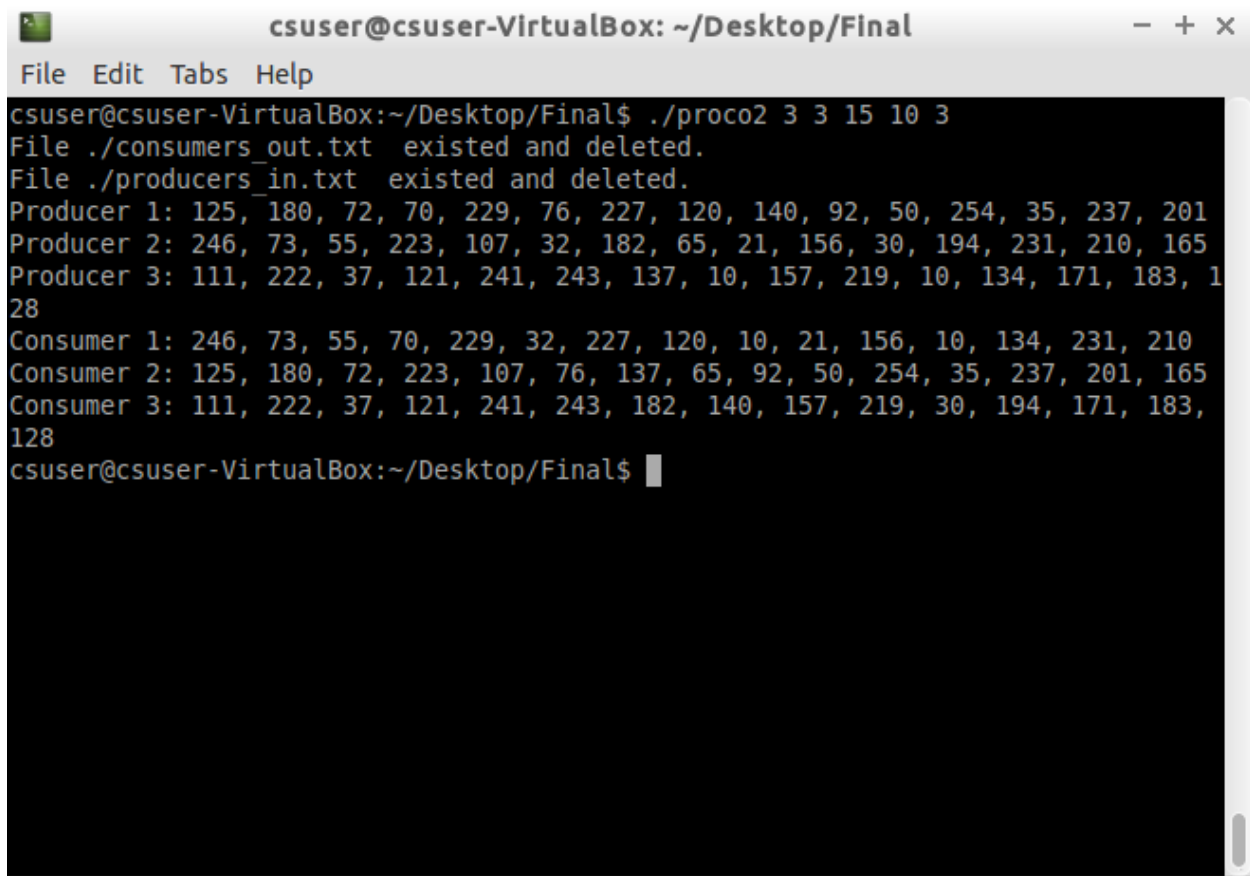


A terminal window titled "csuser@csuser-VirtualBox: ~/Desktop/Final" with a menu bar (File, Edit, Tabs, Help). The terminal shows the execution of the command `./proco2 3 4 15 10 2`. The output indicates that files `./consumers_out.txt` and `./producers_in.txt` existed and were deleted. It then displays 12 lines of data, grouped by Producer and Consumer, each with 12 numerical values. The terminal ends with a prompt `csuser@csuser-VirtualBox:~/Desktop/Final$` and a cursor.

```
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 3 4 15 10 2
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 255, 215, 78, 19, 99, 6, 156, 224, 10, 242, 142, 188, 226, 161, 128
Producer 2: 251, 144, 66, 121, 103, 147, 41, 16, 15, 199, 214, 63, 100, 57, 19
Producer 3: 246, 73, 55, 223, 107, 32, 182, 65, 21, 156, 30, 194, 231, 210, 165
Consumer 1: 215, 66, 121, 6, 41, 65, 242, 142, 194, 231, 128
Consumer 2: 251, 73, 19, 107, 147, 224, 10, 199, 63, 100, 161, 165
Consumer 3: 246, 78, 223, 103, 156, 16, 15, 156, 188, 57, 210
Consumer 4: 255, 144, 55, 99, 32, 182, 21, 214, 30, 226, 19
csuser@csuser-VirtualBox:~/Desktop/Final$
```

producers_in.txt	consumers_out.txt
File Edit Search Options Help	File Edit Search Options Help
Producer 1, 255	Consumer 4, 255
Producer 2, 251	Consumer 2, 251
Producer 3, 246	Consumer 3, 246
Producer 1, 215	Consumer 1, 215
Producer 2, 144	Consumer 4, 144
Producer 3, 73	Consumer 2, 73
Producer 1, 78	Consumer 3, 78
Producer 2, 66	Consumer 1, 66
Producer 3, 55	Consumer 4, 55
Producer 1, 19	Consumer 2, 19
Producer 3, 223	Consumer 3, 223
Producer 2, 121	Consumer 1, 121
Producer 1, 99	Consumer 4, 99
Producer 3, 107	Consumer 2, 107
Producer 2, 103	Consumer 3, 103
Producer 1, 6	Consumer 1, 6
Producer 3, 32	Consumer 4, 32
Producer 2, 147	Consumer 2, 147
Producer 1, 156	Consumer 3, 156
Producer 2, 41	Consumer 1, 41
Producer 3, 182	Consumer 4, 182
Producer 1, 224	Consumer 2, 224
Producer 2, 16	Consumer 3, 16
Producer 3, 65	Consumer 1, 65
Producer 1, 10	Consumer 2, 10
Producer 2, 15	Consumer 3, 15
Producer 3, 21	Consumer 4, 21
Producer 1, 242	Consumer 1, 242
Producer 2, 199	Consumer 2, 199
Producer 2, 214	Consumer 4, 214
Producer 3, 156	Consumer 3, 156
Producer 1, 142	Consumer 1, 142
Producer 2, 63	Consumer 2, 63
Producer 3, 30	Consumer 4, 30
Producer 1, 188	Consumer 3, 188
Producer 3, 194	Consumer 1, 194
Producer 2, 100	Consumer 2, 100
Producer 1, 226	Consumer 4, 226
Producer 2, 57	Consumer 3, 57
Producer 3, 231	Consumer 1, 231
Producer 1, 161	Consumer 2, 161
Producer 2, 19	Consumer 4, 19
Producer 3, 210	Consumer 3, 210
Producer 1, 128	Consumer 1, 128
Producer 3, 165	Consumer 2, 165

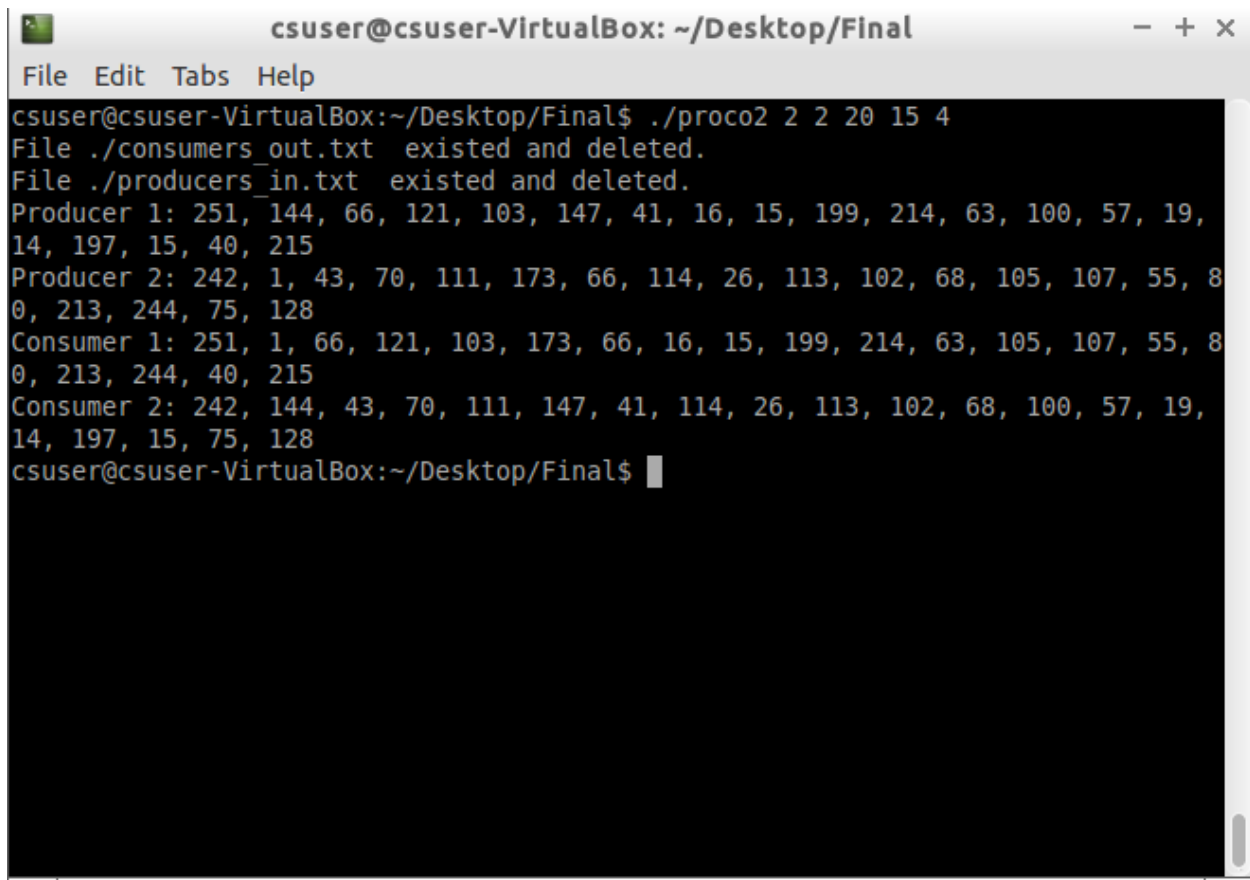
- ./proco2 3 3 15 10 3



```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 3 3 15 10 3
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 125, 180, 72, 70, 229, 76, 227, 120, 140, 92, 50, 254, 35, 237, 201
Producer 2: 246, 73, 55, 223, 107, 32, 182, 65, 21, 156, 30, 194, 231, 210, 165
Producer 3: 111, 222, 37, 121, 241, 243, 137, 10, 157, 219, 10, 134, 171, 183, 128
Consumer 1: 246, 73, 55, 70, 229, 32, 227, 120, 10, 21, 156, 10, 134, 231, 210
Consumer 2: 125, 180, 72, 223, 107, 76, 137, 65, 92, 50, 254, 35, 237, 201, 165
Consumer 3: 111, 222, 37, 121, 241, 243, 182, 140, 157, 219, 30, 194, 171, 183, 128
csuser@csuser-VirtualBox:~/Desktop/Final$
```

producers_in.txt	consumers_out.txt
File Edit Search Options Help	File Edit Search Options Help
Producer 1, 125	Consumer 2, 125
Producer 2, 246	Consumer 1, 246
Producer 3, 111	Consumer 3, 111
Producer 1, 180	Consumer 2, 180
Producer 2, 73	Consumer 1, 73
Producer 3, 222	Consumer 3, 222
Producer 1, 72	Consumer 2, 72
Producer 2, 55	Consumer 1, 55
Producer 3, 37	Consumer 3, 37
Producer 1, 70	Consumer 1, 70
Producer 2, 223	Consumer 2, 223
Producer 3, 121	Consumer 3, 121
Producer 1, 229	Consumer 1, 229
Producer 2, 107	Consumer 2, 107
Producer 3, 241	Consumer 3, 241
Producer 1, 76	Consumer 2, 76
Producer 2, 32	Consumer 1, 32
Producer 3, 243	Consumer 3, 243
Producer 1, 227	Consumer 1, 227
Producer 2, 182	Consumer 3, 182
Producer 3, 137	Consumer 2, 137
Producer 1, 120	Consumer 1, 120
Producer 1, 140	Consumer 3, 140
Producer 2, 65	Consumer 2, 65
Producer 3, 10	Consumer 1, 10
Producer 1, 92	Consumer 2, 92
Producer 3, 157	Consumer 3, 157
Producer 2, 21	Consumer 1, 21
Producer 1, 50	Consumer 2, 50
Producer 3, 219	Consumer 3, 219
Producer 2, 156	Consumer 1, 156
Producer 1, 254	Consumer 2, 254
Producer 2, 30	Consumer 3, 30
Producer 3, 10	Consumer 1, 10
Producer 1, 35	Consumer 2, 35
Producer 2, 194	Consumer 3, 194
Producer 3, 134	Consumer 1, 134
Producer 1, 237	Consumer 2, 237
Producer 3, 171	Consumer 3, 171
Producer 2, 231	Consumer 1, 231
Producer 1, 201	Consumer 2, 201
Producer 3, 183	Consumer 3, 183
Producer 2, 210	Consumer 1, 210
Producer 2, 165	Consumer 2, 165
Producer 3, 128	Consumer 3, 128

- ./proco2 2 2 20 15 4

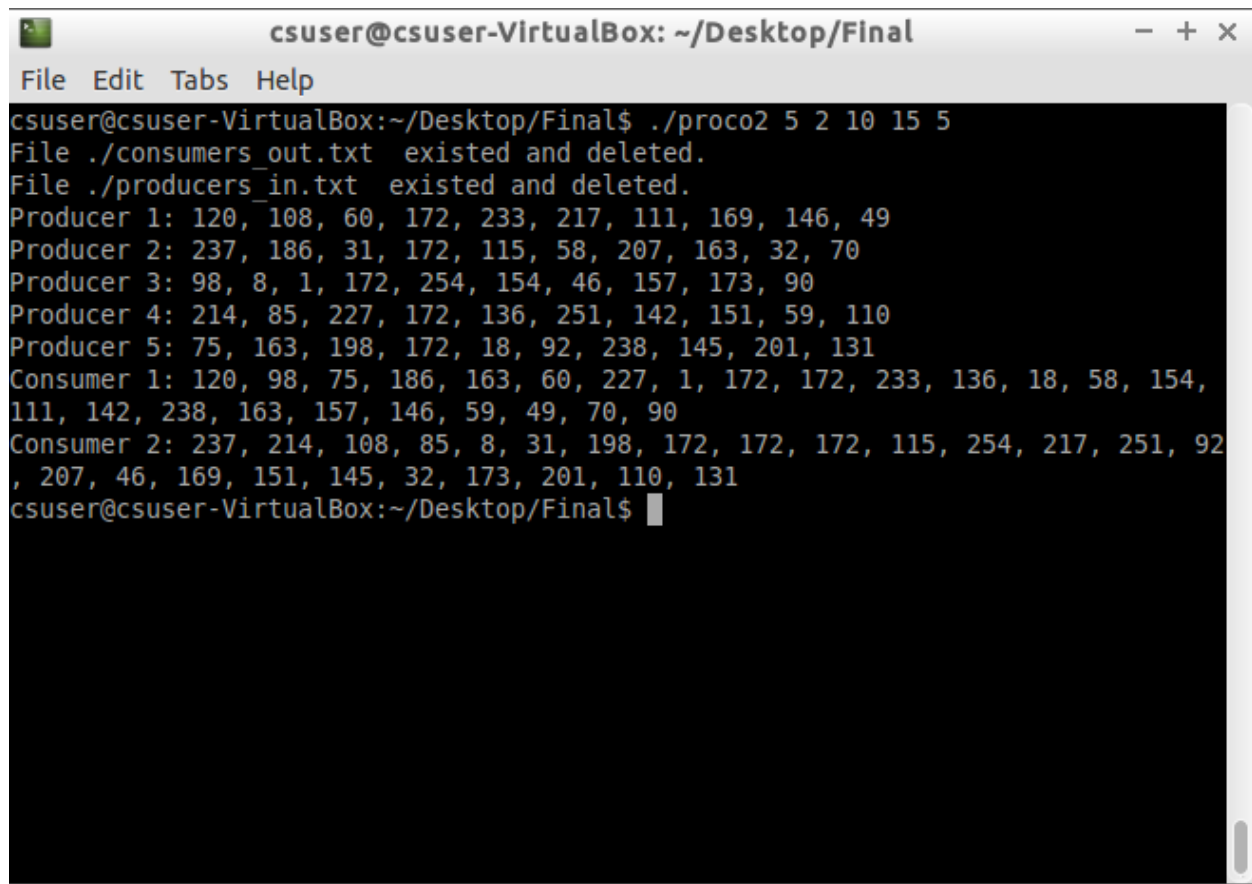


```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 2 2 20 15 4
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 251, 144, 66, 121, 103, 147, 41, 16, 15, 199, 214, 63, 100, 57, 19,
14, 197, 15, 40, 215
Producer 2: 242, 1, 43, 70, 111, 173, 66, 114, 26, 113, 102, 68, 105, 107, 55, 8
0, 213, 244, 75, 128
Consumer 1: 251, 1, 66, 121, 103, 173, 66, 16, 15, 199, 214, 63, 105, 107, 55, 8
0, 213, 244, 40, 215
Consumer 2: 242, 144, 43, 70, 111, 147, 41, 114, 26, 113, 102, 68, 100, 57, 19,
14, 197, 15, 75, 128
csuser@csuser-VirtualBox:~/Desktop/Final$
```



producers_in.txt	consumers_out.txt
File Edit Search Options Help	File Edit Search Options Help
Producer 1, 251	Consumer 1, 251
Producer 2, 242	Consumer 2, 242
Producer 1, 144	Consumer 2, 144
Producer 2, 1	Consumer 1, 1
Producer 2, 43	Consumer 2, 43
Producer 1, 66	Consumer 1, 66
Producer 2, 70	Consumer 2, 70
Producer 1, 121	Consumer 1, 121
Producer 2, 111	Consumer 2, 111
Producer 1, 103	Consumer 1, 103
Producer 1, 147	Consumer 2, 147
Producer 2, 173	Consumer 1, 173
Producer 1, 41	Consumer 2, 41
Producer 2, 66	Consumer 1, 66
Producer 2, 114	Consumer 2, 114
Producer 1, 16	Consumer 1, 16
Producer 2, 26	Consumer 2, 26
Producer 1, 15	Consumer 1, 15
Producer 2, 113	Consumer 2, 113
Producer 1, 199	Consumer 1, 199
Producer 2, 102	Consumer 2, 102
Producer 1, 214	Consumer 1, 214
Producer 2, 68	Consumer 2, 68
Producer 1, 63	Consumer 1, 63
Producer 2, 105	Consumer 1, 105
Producer 1, 100	Consumer 2, 100
Producer 2, 107	Consumer 1, 107
Producer 1, 57	Consumer 2, 57
Producer 2, 55	Consumer 1, 55
Producer 1, 19	Consumer 2, 19
Producer 2, 80	Consumer 1, 80
Producer 1, 14	Consumer 2, 14
Producer 2, 213	Consumer 1, 213
Producer 1, 197	Consumer 2, 197
Producer 2, 244	Consumer 1, 244
Producer 1, 15	Consumer 2, 15
Producer 2, 75	Consumer 2, 75
Producer 1, 40	Consumer 1, 40
Producer 2, 128	Consumer 2, 128
Producer 1, 215	Consumer 1, 215

- ./proco2 5 2 10 15 5



```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 5 2 10 15 5
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 120, 108, 60, 172, 233, 217, 111, 169, 146, 49
Producer 2: 237, 186, 31, 172, 115, 58, 207, 163, 32, 70
Producer 3: 98, 8, 1, 172, 254, 154, 46, 157, 173, 90
Producer 4: 214, 85, 227, 172, 136, 251, 142, 151, 59, 110
Producer 5: 75, 163, 198, 172, 18, 92, 238, 145, 201, 131
Consumer 1: 120, 98, 75, 186, 163, 60, 227, 1, 172, 172, 233, 136, 18, 58, 154,
111, 142, 238, 163, 157, 146, 59, 49, 70, 90
Consumer 2: 237, 214, 108, 85, 8, 31, 198, 172, 172, 172, 115, 254, 217, 251, 92
, 207, 46, 169, 151, 145, 32, 173, 201, 110, 131
csuser@csuser-VirtualBox:~/Desktop/Final$
```

producers_in.txt	consumers_out.txt
File Edit Search Options Help	File Edit Search Options Help
Producer 1, 120	Consumer 1, 120
Producer 2, 237	Consumer 2, 237
Producer 3, 98	Consumer 1, 98
Producer 4, 214	Consumer 2, 214
Producer 5, 75	Consumer 1, 75
Producer 1, 108	Consumer 2, 108
Producer 2, 186	Consumer 1, 186
Producer 4, 85	Consumer 2, 85
Producer 5, 163	Consumer 1, 163
Producer 3, 8	Consumer 2, 8
Producer 1, 60	Consumer 1, 60
Producer 2, 31	Consumer 2, 31
Producer 4, 227	Consumer 1, 227
Producer 5, 198	Consumer 2, 198
Producer 3, 1	Consumer 1, 1
Producer 1, 172	Consumer 2, 172
Producer 2, 172	Consumer 1, 172
Producer 4, 172	Consumer 2, 172
Producer 3, 172	Consumer 1, 172
Producer 5, 172	Consumer 2, 172
Producer 1, 233	Consumer 1, 233
Producer 2, 115	Consumer 2, 115
Producer 4, 136	Consumer 1, 136
Producer 3, 254	Consumer 2, 254
Producer 5, 18	Consumer 1, 18
Producer 1, 217	Consumer 2, 217
Producer 2, 58	Consumer 1, 58
Producer 4, 251	Consumer 2, 251
Producer 3, 154	Consumer 1, 154
Producer 5, 92	Consumer 2, 92
Producer 1, 111	Consumer 1, 111
Producer 2, 207	Consumer 2, 207
Producer 4, 142	Consumer 1, 142
Producer 3, 46	Consumer 2, 46
Producer 5, 238	Consumer 1, 238
Producer 1, 169	Consumer 2, 169
Producer 2, 163	Consumer 1, 163
Producer 4, 151	Consumer 2, 151
Producer 3, 157	Consumer 1, 157
Producer 5, 145	Consumer 2, 145
Producer 1, 146	Consumer 1, 146
Producer 2, 32	Consumer 2, 32
Producer 4, 59	Consumer 1, 59
Producer 3, 173	Consumer 2, 173
Producer 1, 49	Consumer 1, 49
Producer 5, 201	Consumer 2, 201
Producer 2, 70	Consumer 1, 70
Producer 4, 110	Consumer 2, 110
Producer 3, 90	Consumer 1, 90
Producer 5, 131	Consumer 2, 131

- ./proco2 5 10 30 15 5

```
csuser@csuser-VirtualBox: ~/Desktop/Final
File Edit Tabs Help
csuser@csuser-VirtualBox:~/Desktop/Final$ ./proco2 5 10 30 15 5
File ./consumers_out.txt existed and deleted.
File ./producers_in.txt existed and deleted.
Producer 1: 120, 108, 60, 172, 233, 217, 111, 169, 146, 49, 122, 128, 166, 134,
92, 158, 137, 200, 177, 65, 88, 33, 22, 48, 42, 3, 76, 44, 19, 253
Producer 2: 237, 186, 31, 172, 115, 58, 207, 163, 32, 70, 174, 199, 236, 3, 201,
114, 93, 103, 92, 84, 184, 248, 97, 28, 246, 84, 236, 216, 120, 115
Producer 3: 98, 8, 1, 172, 254, 154, 46, 157, 173, 90, 226, 14, 50, 129, 55, 69,
49, 6, 7, 103, 24, 206, 173, 8, 194, 164, 140, 132, 220, 233
Producer 4: 214, 85, 227, 172, 136, 251, 142, 151, 59, 110, 22, 85, 120, 255, 16
5, 25, 4, 164, 178, 122, 119, 164, 248, 244, 143, 244, 45, 47, 65, 95
Producer 5: 75, 163, 198, 172, 18, 92, 238, 145, 201, 131, 75, 156, 190, 124, 19
, 237, 216, 67, 93, 141, 215, 123, 68, 224, 91, 69, 205, 219, 166, 213
Consumer 1: 85, 172, 154, 169, 70, 199, 255, 114, 103, 84, 248, 28, 84, 219, 253
Consumer 2: 214, 198, 18, 207, 59, 75, 236, 92, 49, 177, 24, 248, 42, 140, 65
Consumer 3: 98, 1, 254, 238, 201, 226, 50, 19, 4, 93, 215, 68, 91, 205, 166
Consumer 4: 237, 31, 115, 111, 146, 174, 120, 201, 93, 92, 184, 97, 246, 236, 12
0
Consumer 5: 75, 227, 136, 46, 32, 22, 190, 165, 216, 178, 119, 173, 194, 76, 220
Consumer 6: 108, 172, 217, 163, 110, 85, 3, 25, 67, 122, 123, 244, 244, 216, 115
Consumer 7: 186, 172, 58, 157, 49, 156, 124, 237, 6, 141, 206, 224, 69, 47, 213
Consumer 8: 8, 172, 251, 151, 90, 128, 134, 69, 164, 65, 33, 48, 3, 132, 233
Consumer 9: 163, 172, 92, 145, 131, 14, 129, 158, 200, 103, 164, 8, 164, 44, 95
Consumer 10: 120, 60, 233, 142, 173, 122, 166, 55, 137, 7, 88, 22, 143, 45, 19
csuser@csuser-VirtualBox:~/Desktop/Final$
```

producers_in.txt	consumers_out.txt
File Edit Search Options Help	File Edit Search Options Help
Producer 1, 120	Consumer 10, 120
Producer 2, 237	Consumer 4, 237
Producer 3, 98	Consumer 3, 98
Producer 4, 214	Consumer 2, 214
Producer 5, 75	Consumer 5, 75
Producer 1, 108	Consumer 6, 108
Producer 2, 186	Consumer 7, 186
Producer 3, 8	Consumer 8, 8
Producer 5, 163	Consumer 9, 163
Producer 4, 85	Consumer 1, 85
Producer 1, 60	Consumer 10, 60
Producer 2, 31	Consumer 4, 31
Producer 3, 1	Consumer 3, 1
Producer 5, 198	Consumer 2, 198
Producer 4, 227	Consumer 5, 227
Producer 1, 172	Consumer 6, 172
Producer 2, 172	Consumer 7, 172
Producer 3, 172	Consumer 8, 172
Producer 5, 172	Consumer 9, 172
Producer 4, 172	Consumer 1, 172
Producer 1, 233	Consumer 10, 233
Producer 2, 115	Consumer 4, 115
Producer 3, 254	Consumer 3, 254
Producer 5, 18	Consumer 2, 18
Producer 4, 136	Consumer 5, 136
Producer 1, 217	Consumer 6, 217
Producer 2, 58	Consumer 7, 58
Producer 3, 154	Consumer 1, 154
Producer 5, 92	Consumer 9, 92
Producer 4, 251	Consumer 8, 251
Producer 1, 111	Consumer 4, 111
Producer 2, 207	Consumer 2, 207
Producer 3, 46	Consumer 5, 46
Producer 5, 238	Consumer 3, 238
Producer 4, 142	Consumer 10, 142
Producer 2, 163	Consumer 6, 163
Producer 1, 169	Consumer 1, 169
Producer 3, 157	Consumer 7, 157
Producer 5, 145	Consumer 9, 145
Producer 4, 151	Consumer 8, 151
Producer 1, 146	Consumer 4, 146
Producer 2, 32	Consumer 5, 32
Producer 4, 59	Consumer 2, 59
Producer 5, 201	Consumer 3, 201
Producer 3, 173	Consumer 10, 173
Producer 2, 70	Consumer 1, 70
Producer 4, 110	Consumer 6, 110
Producer 1, 49	Consumer 7, 49
Producer 5, 131	Consumer 9, 131
Producer 3, 90	Consumer 8, 90
Producer 2, 174	Consumer 4, 174
Producer 4, 22	Consumer 5, 22
Producer 5, 75	Consumer 2, 75
Producer 3, 226	Consumer 3, 226
Producer 1, 122	Consumer 10, 122
Producer 2, 199	Consumer 1, 199
Producer 4, 85	Consumer 6, 85
Producer 5, 156	Consumer 7, 156
Producer 3, 14	Consumer 9, 14
Producer 1, 128	Consumer 8, 128
Producer 4, 120	Consumer 4, 120
Producer 5, 190	Consumer 5, 190
Producer 2, 236	Consumer 2, 236
Producer 3, 50	Consumer 3, 50
Producer 1, 166	Consumer 10, 166
Producer 4, 255	Consumer 1, 255
Producer 2, 3	Consumer 6, 3
Producer 5, 124	Consumer 7, 124
Producer 3, 129	Consumer 9, 129
Producer 1, 134	Consumer 8, 134
Producer 2, 201	Consumer 4, 201
Producer 4, 165	Consumer 5, 165
Producer 5, 19	Consumer 3, 19
Producer 1, 92	Consumer 2, 92
Producer 3, 55	Consumer 10, 55

Producer 2, 114	Consumer 1, 114
Producer 4, 25	Consumer 6, 25
Producer 5, 237	Consumer 7, 237
Producer 1, 158	Consumer 9, 158
Producer 3, 69	Consumer 8, 69
Producer 2, 93	Consumer 4, 93
Producer 4, 4	Consumer 3, 4
Producer 5, 216	Consumer 5, 216
Producer 1, 137	Consumer 10, 137
Producer 3, 49	Consumer 2, 49
Producer 2, 103	Consumer 1, 103
Producer 5, 67	Consumer 6, 67
Producer 3, 6	Consumer 7, 6
Producer 4, 164	Consumer 8, 164
Producer 1, 200	Consumer 9, 200
Producer 2, 92	Consumer 4, 92
Producer 5, 93	Consumer 3, 93
Producer 4, 178	Consumer 5, 178
Producer 3, 7	Consumer 10, 7
Producer 1, 177	Consumer 2, 177
Producer 2, 84	Consumer 1, 84
Producer 5, 141	Consumer 7, 141
Producer 4, 122	Consumer 6, 122
Producer 1, 65	Consumer 8, 65
Producer 3, 103	Consumer 9, 103
Producer 2, 184	Consumer 4, 184
Producer 5, 215	Consumer 3, 215
Producer 4, 119	Consumer 5, 119
Producer 3, 24	Consumer 2, 24
Producer 1, 88	Consumer 10, 88
Producer 2, 248	Consumer 1, 248
Producer 5, 123	Consumer 6, 123
Producer 3, 206	Consumer 7, 206
Producer 1, 33	Consumer 8, 33
Producer 4, 164	Consumer 9, 164
Producer 2, 97	Consumer 4, 97
Producer 5, 68	Consumer 3, 68
Producer 4, 248	Consumer 2, 248
Producer 1, 22	Consumer 10, 22
Producer 3, 173	Consumer 5, 173
Producer 2, 28	Consumer 1, 28
Producer 5, 224	Consumer 7, 224
Producer 4, 244	Consumer 6, 244
Producer 1, 48	Consumer 8, 48
Producer 3, 8	Consumer 9, 8
Producer 2, 246	Consumer 4, 246
Producer 5, 91	Consumer 3, 91
Producer 4, 143	Consumer 10, 143
Producer 1, 42	Consumer 2, 42
Producer 3, 194	Consumer 5, 194
Producer 2, 84	Consumer 1, 84
Producer 5, 69	Consumer 7, 69
Producer 4, 244	Consumer 6, 244
Producer 1, 3	Consumer 8, 3
Producer 3, 164	Consumer 9, 164
Producer 2, 236	Consumer 4, 236
Producer 5, 205	Consumer 3, 205
Producer 4, 45	Consumer 10, 45
Producer 1, 76	Consumer 5, 76
Producer 3, 140	Consumer 2, 140
Producer 2, 216	Consumer 6, 216
Producer 5, 219	Consumer 1, 219
Producer 4, 47	Consumer 7, 47
Producer 3, 132	Consumer 8, 132
Producer 1, 44	Consumer 9, 44
Producer 2, 120	Consumer 4, 120
Producer 5, 166	Consumer 3, 166
Producer 1, 19	Consumer 10, 19
Producer 3, 220	Consumer 5, 220
Producer 4, 65	Consumer 2, 65
Producer 2, 115	Consumer 6, 115
Producer 1, 253	Consumer 1, 253
Producer 5, 213	Consumer 7, 213
Producer 3, 233	Consumer 8, 233
Producer 4, 95	Consumer 9, 95