

МИНИСТЕРСТВО ОБРАЗОВАНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ

УЧРЕЖДЕНИЕ ОБРАЗОВАНИЯ

БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ
ИНФОРМАТИКИ И РАДИОЭЛЕКТРОНИКИ

Кафедра электронных вычислительных машин

Лабораторная работа № 7
По дисциплине ОСиСП

«Блокировки чтения/записи и условные переменные»

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1 ПОСТАНОВКА ЗАДАЧИ

Написать две программы.

1.1 Постановка задачи для первой программы

Первая заключается в том, что основной поток создает очередь сообщений, после чего ожидает и обрабатывает нажатия клавиш, порождая и завершая потоки двух типов — производители и потребители.

Очередь сообщений представляет собой кольцевой буфер, содержащий указатели на сообщения, и пара указателей на голову и хвост. Помимо этого, очередь содержит счетчик добавленных сообщений и счетчик извлеченных.

Производители формируют сообщения и, если в очереди есть место, помещают их туда.

Потребители, если в очереди есть сообщения, извлекают их оттуда, обрабатывают и освобождают с ними связанную память.

Для работы используются две условных переменных для заполнения буфера и извлечения из него, а также мьютекс для монопольного доступа к очереди.

Сообщения имеют следующий формат (размер и смещение в байтах):

Имя	Размер	Смещение	Описание
type	1	0	тип сообщения
hash	2	1	контрольные данные
size	1	3	длина данных в байтах
data	$((size + 3)/4)*4$	4	данные сообщения

Производители генерируют сообщения, используя системный генератор rand для size и data. В качестве результата для size используется остаток от деления на 257.

Если остаток от деления равен нулю, rand(3) вызывается повторно. Если остаток от деления равен 256, значение size устанавливается равным 0, реальная длина сообщения при этом составляет 256 байт.

При формировании сообщения контрольные данные формируются из всех байт сообщения.

После помещения значения в очередь перед освобождением мьютекса очереди производитель инкрементирует счетчик добавленных сообщений.

Потребитель, получив доступ к очереди, извлекает сообщение и удаляет его из очереди. Перед освобождением мьютекса очереди инкрементирует счетчик извлеченных сообщений.

При получении сигнала о завершении процесс должен завершить свой цикл и только после этого завершиться, не входя в новый.

1.2 Постановка задачи для второй программы

Вторая программа реализует конкурентный доступ к файлу. Она читает из и пишет в файл, содержащий записи фиксированного формата. Примерный формат записи:

```
struct record_s {  
    char name[80]; // Ф.И.О. студента  
    char address[80]; // адрес проживания  
    uint8_t semester; // семестр  
}
```

Программа должна выполнять следующие операции:

- 1) Отображение содержимого файла с последовательной нумерацией записей.
- 2) Получение записи с порядковым номером.
- 3) Модификация полей записи.
- 4) Сохранение последней прочитанной и модифицированной записи по месту.

2 АЛГОРИТМ

2.1 Алгоритм для первой программы

Алгоритм основного потока для решения поставленной задачи:

- 1) Создание и инициализация условных переменных и мьютекса.
- 2) Инициализация элементов очереди.
- 3) Обработка команд пользователя.

Алгоритм производителя для решения поставленной задачи:

- 1) Генерация сообщения.
- 2) Его добавление в буфер при наличии свободного места.

Алгоритм потребителя для решения поставленной задачи:

- 1) Считывание сообщения из буфера при его наличии.
- 2) Вывод сообщения на экран как его обработки.

2.2 Алгоритм второй программы

- 1) Вывод содержимого файла при выборе пользователя.
- 2) Добавление элементов в файл при выборе пользователя.
- 3) Выбор определенной записи из файла при выборе пользователя.
- 4) Редактирование выбранной записи при выборе пользователя.
- 5) Сохранение в файл отредактированной записи при выборе пользователя.

3 ТЕСТ ПРОГРАММЫ

3.1 Тест первой программы

```
[niks0@fedora oslab7]$ ./oslab71

m - Show menu
p - Create producer
c - Create consumer
d - Delete producer
e - Delete consumer
s - Get statistic
l - See Messages in buffer
+ - Increase message buffer
- - Decrease message buffer
q - Quit

You Can Enter Your Choice:
s

---Messages Buff Stats:---
Number of Messages in buffer:1
Max Number of Messages:13
Number of Added messages:1
Number of Processed Messages:0

---No Working Producers---

---No Working Consumers---

You Can Enter Your Choice:
l

Head&Tail inds:[0][1]
_MSG[0]: {68}{346}{5}{ 33 77 77 97 33 }

You Can Enter Your Choice:
p

Parent Created 0 Producer_14021135665536_
Producer Pthread_0 ADDED MSG

You Can Enter Your Choice:
p

Parent Created 1 Producer_140211348272832_
Producer Pthread_1 ADDED MSG

You Can Enter Your Choice:
p

Parent Created 2 Producer_140211339880128_
```

Producer Pthread_2 ADDED MSG

You Can Enter Your Choice:

p

Parent Created 3 Producer_140211331487424_

Producer Pthread_3 ADDED MSG

You Can Enter Your Choice:

p

Parent Created 4 Producer_140211323094720_

Producer Pthread_4 ADDED MSG

You Can Enter Your Choice:

p

Parent Created 5 Producer_140211314702016_

Producer Pthread_5 ADDED MSG

You Can Enter Your Choice:

Producer Pthread_0 ADDED MSG

c

Producer Pthread_1 ADDED MSG

Parent Created Consumer_140211306309312_

Consumer_0_ Pthread Processed MSG:

{68}{346}{5}{ 33 77 77 97 33 }

You Can Enter Your Choice:

c

Producer Pthread_2 ADDED MSG

Parent Created Consumer_140211297916608_

Consumer_1_ Pthread Processed MSG:

{7}{15541}{178}{ 130 110 2 63 75 63 59 77 102 156 85 140
32 106 23 40 19 118 42 111 99 34 90 128 159 129 25 1 2
75 111 133 6 113 16 133 48 127 31 151 103 116 111 136
94 6 48 113 124 142 44 96 176 6 44 155 135 122 29 10
17 140 15 23 73 31 157 122 158 60 145 134 48 76 142 142
82 62 75 78 24 171 174 73 177 91 100 5 33 129 15 50 89
30 126 163 113 155 157 143 35 122 149 83 70 163 97 24
45 172 102 70 35 149 15 32 60 115 89 93 65 156 15 154
58 13 9 43 168 166 59 75 108 28 30 50 64 127 74 109
171 177 51 26 18 66 111 78 2 20 43 119 49 110 145 159
124 155 23 164 13 82 112 122 162 142 172 46 142 119 28
133 116 79 32 6 18 143 }

You Can Enter Your Choice:

c

Producer Pthread_3 ADDED MSG

Parent Created Consumer_140211289523904_

Consumer_2_ Pthread Processed MSG:

```
{7}{15541}{178}{ 130 110 2 63 75 63 59 77 102 156 85 140
32 106 23 40 19 118 42 111 99 34 90 128 159 129 25 1 2
75 111 133 6 113 16 133 48 127 31 151 103 116 111 136
94 6 48 113 124 142 44 96 176 6 44 155 135 122 29 10
17 140 15 23 73 31 157 122 158 60 145 134 48 76 142 142
82 62 75 78 24 171 174 73 177 91 100 5 33 129 15 50 89
30 126 163 113 155 157 143 35 122 149 83 70 163 97 24
45 172 102 70 35 149 15 32 60 115 89 93 65 156 15 154
58 13 9 43 168 166 59 75 108 28 30 50 64 127 74 109
171 177 51 26 18 66 111 78 2 20 43 119 49 110 145 159
124 155 23 164 13 82 112 122 162 142 172 46 142 119 28
133 116 79 32 6 18 143 }
```

You Can Enter Your Choice:

c

Parent Created Consumer_140211281131200_

Consumer_3_ Pthread Processed MSG:

```
{9}{14618}{158}{ 175 143 79 72 5 87 87 118 54 142 177 135
79 128 20 36 39 35 72 147 125 5 172 126 138 55 108 175
156 139 125 23 102 76 95 159 163 54 97 89 16 147 45 95
95 65 3 7 152 76 154 150 133 18 148 91 74 76 87 102 35
84 125 137 160 93 117 15 147 86 104 36 53 21 3 21 138
7 28 163 135 54 133 88 73 101 0 19 177 139 121 33 43
118 170 75 31 159 90 51 118 66 87 171 140 142 12 98 149
92 81 156 147 34 65 92 7 117 111 5 76 104 38 171 42 80
66 126 112 28 177 50 94 84 93 106 98 158 77 120 70 30
96 89 117 33 53 124 150 164 129 98 140 39 89 3 120 155
}
```

You Can Enter Your Choice:

Producer Pthread_4 ADDED MSG

c

Parent Created Consumer_140211272738496_

Consumer_4_ Pthread Processed MSG:

```
{9}{14618}{158}{ 175 143 79 72 5 87 87 118 54 142 177 135
79 128 20 36 39 35 72 147 125 5 172 126 138 55 108 175
156 139 125 23 102 76 95 159 163 54 97 89 16 147 45 95
95 65 3 7 152 76 154 150 133 18 148 91 74 76 87 102 35
84 125 137 160 93 117 15 147 86 104 36 53 21 3 21 138
7 28 163 135 54 133 88 73 101 0 19 177 139 121 33 43
118 170 75 31 159 90 51 118 66 87 171 140 142 12 98 149
92 81 156 147 34 65 92 7 117 111 5 76 104 38 171 42 80
66 126 112 28 177 50 94 84 93 106 98 158 77 120 70 30
```

96 89 117 33 53 124 150 164 129 98 140 39 89 3 120 155
}

You Can Enter Your Choice:

Producer Pthread_5 ADDED MSG
c

Parent Created Consumer_140211264345792_

Consumer_5_ Pthread Processed MSG:

{8}{5989}{70}{ 6 121 37 169 11 174 11 18 40 78 36 83 133
64 60 162 139 112 128 6 24 148 63 132 62 150 165 5 47
56 66 53 177 155 94 60 149 105 130 9 55 167 92 61 103
24 43 114 136 171 172 33 11 107 37 126 78 22 3 125 78
69 50 127 96 144 59 65 121 62 }

You Can Enter Your Choice:

Producer Pthread_0 ADDED MSG

Producer Pthread_1 ADDED MSG

Consumer_0_ Pthread Processed MSG:

{8}{5989}{70}{ 6 121 37 169 11 174 11 18 40 78 36 83 133
64 60 162 139 112 128 6 24 148 63 132 62 150 165 5 47
56 66 53 177 155 94 60 149 105 130 9 55 167 92 61 103
24 43 114 136 171 172 33 11 107 37 126 78 22 3 125 78
69 50 127 96 144 59 65 121 62 }

Producer Pthread_2 ADDED MSG

Consumer_1_ Pthread Processed MSG:

{7}{12117}{151}{ 129 162 17 48 163 17 158 53 179 32 67 11
109 44 132 38 13 18 3 40 151 173 114 36 11 166 33 39
12 4 136 141 39 25 9 22 42 40 127 94 124 14 105 106
111 57 16 124 127 19 36 98 64 23 7 75 9 40 114 73 96
122 87 7 148 148 30 62 8 157 28 133 44 5 111 155 114
127 151 61 146 59 32 31 82 39 158 91 131 145 37 99 139
124 107 159 92 9 42 153 38 122 106 134 128 37 161 62 36
132 176 2 12 28 33 146 119 64 58 122 29 95 41 168 91
20 148 3 81 62 28 120 4 6 126 132 95 108 67 131 60 63
134 124 143 39 91 134 103 21 76 }

Producer Pthread_3 ADDED MSG

Consumer_2_ Pthread Processed MSG:

{7}{12117}{151}{ 129 162 17 48 163 17 158 53 179 32 67 11
109 44 132 38 13 18 3 40 151 173 114 36 11 166 33 39
12 4 136 141 39 25 9 22 42 40 127 94 124 14 105 106
111 57 16 124 127 19 36 98 64 23 7 75 9 40 114 73 96
122 87 7 148 148 30 62 8 157 28 133 44 5 111 155 114
127 151 61 146 59 32 31 82 39 158 91 131 145 37 99 139
124 107 159 92 9 42 153 38 122 106 134 128 37 161 62 36
132 176 2 12 28 33 146 119 64 58 122 29 95 41 168 91
20 148 3 81 62 28 120 4 6 126 132 95 108 67 131 60 63

134 124 143 39 91 134 103 21 76 }

Consumer_3_Pthread Processed MSG:

```
{5}{15547}{169}{ 47 73 16 94 15 72 57 18 97 148 50 150 67
152 19 136 156 106 166 130 81 54 167 63 137 120 95 149
86 136 36 5 81 52 151 149 176 28 167 94 176 37 64 115
10 135 124 38 113 110 40 14 164 80 129 122 20 96 143
107 104 51 164 6 155 136 155 152 36 14 118 33 52 2 148
62 9 92 152 174 75 12 8 59 92 10 53 113 158 68 92 83
119 128 141 95 136 168 119 173 2 57 78 54 111 98 168
120 63 12 114 138 25 174 17 169 56 123 102 35 11 66 170
3 15 131 98 23 119 89 16 173 146 146 100 77 65 88 69
128 153 55 86 178 49 155 39 158 98 142 13 162 80 3 165
95 6 135 171 177 44 7 170 10 26 90 139 91 51 }
```

Producer Pthread_4 ADDED MSG

Consumer_4_Pthread Processed MSG:

```
{5}{15547}{169}{ 47 73 16 94 15 72 57 18 97 148 50 150 67
152 19 136 156 106 166 130 81 54 167 63 137 120 95 149
86 136 36 5 81 52 151 149 176 28 167 94 176 37 64 115
10 135 124 38 113 110 40 14 164 80 129 122 20 96 143
107 104 51 164 6 155 136 155 152 36 14 118 33 52 2 148
62 9 92 152 174 75 12 8 59 92 10 53 113 158 68 92 83
119 128 141 95 136 168 119 173 2 57 78 54 111 98 168
120 63 12 114 138 25 174 17 169 56 123 102 35 11 66 170
3 15 131 98 23 119 89 16 173 146 146 100 77 65 88 69
128 153 55 86 178 49 155 39 158 98 142 13 162 80 3 165
95 6 135 171 177 44 7 170 10 26 90 139 91 51 }
```

Producer Pthread_5 ADDED MSG

Consumer_5_Pthread Processed MSG:

```
{1}{3481}{45}{ 2 121 46 98 72 132 24 60 46 76 63 158 118
101 41 101 146 140 7 73 2 39 18 92 113 4 17 115 37 62
117 40 4 35 138 128 167 34 9 86 162 124 116 100 97 }
```

Producer Pthread_0 ADDED MSG

Producer Pthread_1 ADDED MSG

Consumer_0_Pthread Processed MSG:

```
{1}{3481}{45}{ 2 121 46 98 72 132 24 60 46 76 63 158 118
101 41 101 146 140 7 73 2 39 18 92 113 4 17 115 37 62
117 40 4 35 138 128 167 34 9 86 162 124 116 100 97 }
```

Producer Pthread_2 ADDED MSG

Consumer_1_Pthread Processed MSG:

```
{8}{3420}{37}{ 18 60 106 15 91 179 158 28 112 148 27 94
126 50 1 62 44 138 53 171 69 172 52 59 45 179 46 118
100 135 16 170 67 122 57 158 174 }
```

Producer Pthread_3 ADDED MSG

Consumer_2_Pthread Processed MSG:


```
{8}{3420}{37}{ 18 60 106 15 91 179 158 28 112 148 27 94
126 50 1 62 44 138 53 171 69 172 52 59 45 179 46 118
100 135 16 170 67 122 57 158 174 }
```

Consumer_3_Pthread Processed MSG:

```
{5}{7732}{79}{ 130 157 75 60 83 7 0 151 114 141 175 153
38 113 153 127 9 176 164 43 115 161 98 94 101 61 3 36
76 135 54 26 164 129 86 68 8 139 91 174 100 87 19 11
20 172 138 81 169 122 124 156 155 94 122 77 155 177 165
104 132 91 130 117 40 89 57 100 48 148 94 20 55 166 31
127 30 41 80 }
```

Producer Pthread_4 ADDED MSG

Consumer_4_Pthread Processed MSG:

```
{5}{7732}{79}{ 130 157 75 60 83 7 0 151 114 141 175 153
38 113 153 127 9 176 164 43 115 161 98 94 101 61 3 36
76 135 54 26 164 129 86 68 8 139 91 174 100 87 19 11
20 172 138 81 169 122 124 156 155 94 122 77 155 177 165
104 132 91 130 117 40 89 57 100 48 148 94 20 55 166 31
127 30 41 80 }
```

Producer Pthread_5 ADDED MSG

Consumer_5_Pthread Processed MSG:

```
{2}{15645}{173}{ 56 14 141 107 71 53 57 170 104 111 99 48
52 48 165 11 153 107 150 24 9 101 167 123 179 104 126
130 65 172 154 173 6 167 100 129 40 30 120 17 141 91 65
65 140 103 77 165 30 47 62 91 148 101 34 20 25 33 22
142 25 176 135 83 163 108 33 76 138 25 93 151 168 30 36
128 133 113 166 164 33 100 75 53 21 162 73 46 67 147 60
144 15 67 47 179 175 132 127 5 29 40 156 18 70 65 18
76 50 4 60 83 104 7 9 177 169 134 43 108 102 155 72
117 43 172 168 90 124 115 96 26 27 124 44 98 61 62 174
112 119 106 67 95 113 76 93 155 31 8 135 133 164 28 122
27 72 111 117 68 46 85 94 74 82 138 44 143 73 90 127
12 68 }
```

Producer Pthread_0 ADDED MSG

Producer Pthread_1 ADDED MSG

Consumer_0_Pthread Processed MSG:

```
{2}{15645}{173}{ 56 14 141 107 71 53 57 170 104 111 99 48
52 48 165 11 153 107 150 24 9 101 167 123 179 104 126
130 65 172 154 173 6 167 100 129 40 30 120 17 141 91 65
65 140 103 77 165 30 47 62 91 148 101 34 20 25 33 22
142 25 176 135 83 163 108 33 76 138 25 93 151 168 30 36
128 133 113 166 164 33 100 75 53 21 162 73 46 67 147 60
144 15 67 47 179 175 132 127 5 29 40 156 18 70 65 18
76 50 4 60 83 104 7 9 177 169 134 43 108 102 155 72
117 43 172 168 90 124 115 96 26 27 124 44 98 61 62 174
112 119 106 67 95 113 76 93 155 31 8 135 133 164 28 122
27 72 111 117 68 46 85 94 74 82 138 44 143 73 90 127
12 68 }
```

Producer Pthread_2 ADDED MSG

Consumer_1_ Pthread Processed MSG:

```
{5}{11424}{123}{ 124 37 125 24 118 138 153 6 35 160 18 117
101 33 13 124 96 115 119 83 177 30 63 15 166 139 152
111 2 147 46 126 56 172 22 174 130 47 53 37 28 123 155
1 156 168 178 73 155 117 28 153 147 91 168 134 51 12 65
53 160 112 51 88 156 73 83 158 172 136 67 20 79 94 74
107 135 72 52 110 9 81 135 156 172 124 162 43 8 48 148
40 32 19 129 60 144 84 38 9 40 157 29 171 72 155 150
27 47 23 137 108 104 93 137 96 89 119 12 149 39 160 10
}
```

Producer Pthread_3 ADDED MSG

Consumer_2_ Pthread Processed MSG:

```
{5}{11424}{123}{ 124 37 125 24 118 138 153 6 35 160 18 117
101 33 13 124 96 115 119 83 177 30 63 15 166 139 152
111 2 147 46 126 56 172 22 174 130 47 53 37 28 123 155
1 156 168 178 73 155 117 28 153 147 91 168 134 51 12 65
53 160 112 51 88 156 73 83 158 172 136 67 20 79 94 74
107 135 72 52 110 9 81 135 156 172 124 162 43 8 48 148
40 32 19 129 60 144 84 38 9 40 157 29 171 72 155 150
27 47 23 137 108 104 93 137 96 89 119 12 149 39 160 10
}
```

Consumer_3_ Pthread Processed MSG:

```
{3}{10929}{128}{ 110 33 122 36 8 102 10 41 122 67 118 40
7 40 146 53 11 94 43 170 137 49 67 74 161 160 147 105
167 96 28 149 129 22 5 9 124 15 102 119 134 40 159 13
80 177 67 92 91 162 134 101 84 21 47 65 53 15 43 41
111 123 62 112 146 68 121 142 135 43 81 90 136 112 103
36 109 42 0 73 77 134 46 161 28 93 46 81 108 141 174
91 85 57 75 103 177 16 65 132 112 19 42 68 131 18 156
113 60 157 58 137 163 156 170 11 69 89 145 50 50 11 13
7 68 89 110 65 }
```

Producer Pthread_4 ADDED MSG

Consumer_4_ Pthread Processed MSG:

```
{3}{10929}{128}{ 110 33 122 36 8 102 10 41 122 67 118 40
7 40 146 53 11 94 43 170 137 49 67 74 161 160 147 105
167 96 28 149 129 22 5 9 124 15 102 119 134 40 159 13
80 177 67 92 91 162 134 101 84 21 47 65 53 15 43 41
111 123 62 112 146 68 121 142 135 43 81 90 136 112 103
36 109 42 0 73 77 134 46 161 28 93 46 81 108 141 174
91 85 57 75 103 177 16 65 132 112 19 42 68 131 18 156
113 60 157 58 137 163 156 170 11 69 89 145 50 50 11 13
7 68 89 110 65 }
```

Producer Pthread_5 ADDED MSG

Consumer_5_ Pthread Processed MSG:

```
{6}{5886}{65}{ 22 68 176 40 177 93 101 171 6 174 29 22 46
172 72 30 102 122 144 68 121 101 122 162 44 34 99 44 82
36 110 156 104 106 17 101 20 170 144 78 164 174 100 82
```

```
38 44 164 140 39 1 81 160 102 75 14 18 109 113 62 11
22 172 39 126 150 }
d
```

Last created Producer is successfully deleted. 5 Producers left

You Can Enter Your Choice:

d

Last created Producer is successfully deleted. 4 Producers left

You Can Enter Your Choice:

d

Last created Producer is successfully deleted. 3 Producers left

You Can Enter Your Choice:

d

Producer Pthread_0 ADDED MSG

Last created Producer is successfully deleted. 2 Producers left

You Can Enter Your Choice:

d

Last created Producer is successfully deleted. 1 Producers left

You Can Enter Your Choice:

d

Consumer_0_ Pthread Processed MSG:

```
{6}{5886}{65}{ 22 68 176 40 177 93 101 171 6 174 29 22 46
172 72 30 102 122 144 68 121 101 122 162 44 34 99 44 82
36 110 156 104 106 17 101 20 170 144 78 164 174 100 82
38 44 164 140 39 1 81 160 102 75 14 18 109 113 62 11
22 172 39 126 150 }
```

Last created Producer is successfully deleted. 0 Producers left

You Can Enter Your Choice:

d

No Producers to delete

You Can Enter Your Choice:

Consumer_1_ Pthread Processed MSG:

```
{2}{3461}{39}{ 58 162 21 101 18 33 91 157 127 127 113 12
141 162 128 45 87 114 155 51 139 46 51 166 74 36 100
137 165 11 11 43 45 33 16 115 66 159 145 }
```

Consumer_2_ Pthread Processed MSG:

```
{2}{3461}{39}{ 58 162 21 101 18 33 91 157 127 127 113 12
141 162 128 45 87 114 155 51 139 46 51 166 74 36 100
137 165 11 11 43 45 33 16 115 66 159 145 }
```

d

No Producers to delete

You Can Enter Your Choice:

Consumer_3_ Pthread Processed MSG:

```
{5}{16052}{178}{ 2 120 32 29 118 141 1 174 23 160 110 106
57 176 12 176 143 117 21 77 167 84 32 54 156 159 125 93
149 123 98 152 115 2 53 54 143 54 48 39 87 30 145 144
79 158 140 94 147 34 171 6 118 76 61 146 55 6 60 77 1
30 49 117 85 102 43 100 28 143 139 115 46 105 132 125
135 144 39 154 178 83 32 169 31 93 7 138 151 119 35 153
150 136 142 107 110 57 27 139 20 167 126 118 92 78 63
99 43 155 73 93 58 157 134 141 71 14 99 94 133 7 119
155 143 81 82 74 10 110 85 31 97 83 21 61 162 85 160
77 60 105 42 170 82 49 3 25 63 102 120 16 161 59 172
125 13 74 71 23 56 156 106 153 59 128 34 93 85 66 42
17 43 85 59 178 6 62 }
```

Consumer_4_ Pthread Processed MSG:

```
{5}{16052}{178}{ 2 120 32 29 118 141 1 174 23 160 110 106
57 176 12 176 143 117 21 77 167 84 32 54 156 159 125 93
149 123 98 152 115 2 53 54 143 54 48 39 87 30 145 144
79 158 140 94 147 34 171 6 118 76 61 146 55 6 60 77 1
30 49 117 85 102 43 100 28 143 139 115 46 105 132 125
135 144 39 154 178 83 32 169 31 93 7 138 151 119 35 153
150 136 142 107 110 57 27 139 20 167 126 118 92 78 63
99 43 155 73 93 58 157 134 141 71 14 99 94 133 7 119
155 143 81 82 74 10 110 85 31 97 83 21 61 162 85 160
77 60 105 42 170 82 49 3 25 63 102 120 16 161 59 172
125 13 74 71 23 56 156 106 153 59 128 34 93 85 66 42
17 43 85 59 178 6 62 }
```

Consumer_5_ Pthread Processed MSG:

```
{0}{8917}{101}{ 47 163 169 166 86 40 22 137 28 70 30 151
74 7 125 142 66 92 67 117 37 168 103 159 100 160 139 69
164 112 19 83 95 9 69 2 101 143 11 1 34 41 25 108 48
150 70 114 63 9 104 152 177 27 3 149 7 143 38 43 127
110 178 43 119 120 97 92 83 108 145 117 22 170 97 122
141 168 109 76 49 33 48 47 60 104 16 119 67 107 162 14
37 160 109 28 152 78 120 56 59 }
```

c

Consumer_0_ Pthread Processed MSG:

```
{0}{8917}{101}{ 47 163 169 166 86 40 22 137 28 70 30 151
74 7 125 142 66 92 67 117 37 168 103 159 100 160 139 69
164 112 19 83 95 9 69 2 101 143 11 1 34 41 25 108 48
150 70 114 63 9 104 152 177 27 3 149 7 143 38 43 127
110 178 43 119 120 97 92 83 108 145 117 22 170 97 122
141 168 109 76 49 33 48 47 60 104 16 119 67 107 162 14
37 160 109 28 152 78 120 56 59 }
```

Parent Created Consumer_140211356665536_

Consumer_6_ Pthread Processed MSG:

```
{9}{4206}{51}{ 20 96 97 137 7 63 100 156 70 80 15 100 73
68 74 81 137 81 43 53 31 120 105 94 5 86 137 177 125 8
6 17 104 103 155 163 38 127 12 109 27 27 81 153 96 155
106 53 56 21 158 }
```

You Can Enter Your Choice:

e

Last created Consumer is successfully deleted. 6 Consumers left

You Can Enter Your Choice:

s

---Messages Buff Stats:---

Number of Messages in buffer:0

Max Number of Messages:13

Number of Added messages:32

Number of Processed Messages:32

---No Working Producers---

---Working Consumers:

Consumer_0 Pthread: 140211306309312;

Consumer_1 Pthread: 140211297916608;

Consumer_2 Pthread: 140211289523904;

Consumer_3 Pthread: 140211281131200;

Consumer_4 Pthread: 140211272738496;

Consumer_5 Pthread: 140211264345792;

You Can Enter Your Choice:

e

Last created Consumer is successfully deleted. 5 Consumers left

You Can Enter Your Choice:

e

Last created Consumer is successfully deleted. 4 Consumers left

You Can Enter Your Choice:

e

Last created Consumer is successfully deleted. 3 Consumers left

You Can Enter Your Choice:

e

Last created Consumer is successfully deleted. 2 Consumers left

You Can Enter Your Choice:

e

Last created Consumer is successfully deleted. 1 Consumers left

You Can Enter Your Choice:

p

Parent Created 0 Producer_140211297916608_

Producer Pthread_0 ADDED MSG

You Can Enter Your Choice:

p

Consumer_0_ Pthread Processed MSG:

{7}{403}{5}{ 63 53 75 90 122 }

Parent Created 1 Producer_140211289523904_

Producer Pthread_1 ADDED MSG

You Can Enter Your Choice:

p

Parent Created 2 Producer_140211281131200_

Producer Pthread_2 ADDED MSG

You Can Enter Your Choice:

Producer Pthread_0 ADDED MSG

Consumer_0_ Pthread Processed MSG:

{1}{7810}{82}{ 106 34 146 84 61 55 66 131 120 176 78 89
11 108 113 171 83 98 159 21 171 177 143 71 11 26 13 62
92 147 154 18 1 120 154 115 47 41 118 167 89 16 76 100
124 61 144 80 160 123 101 23 120 64 95 132 90 108 66 55
75 40 73 128 32 100 115 132 141 105 171 102 122 120 23
118 1 167 18 161 162 119 }

Producer Pthread_1 ADDED MSG

Producer Pthread_2 ADDED MSG

s

---Messages Buff Stats:---

Number of Messages in buffer:4

Max Number of Messages:13

Number of Added messages:38

Number of Processed Messages:34

---Working Producers:

Producer_0 Pthread: 140211297916608;

Producer_1 Pthread: 140211289523904;

Producer_2 Pthread: 140211281131200;

---Working Consumers:

Consumer_0 Pthread: 140211306309312;

You Can Enter Your Choice:

l

```

Head&Tail inds:[8][12]
_MSG[8]: {1}{7810}{82}{ 106 34 146 84 61 55 66 131 120 176
78 89 11 108 113 171 83 98 159 21 171 177 143 71 11 26
13 62 92 147 154 18 1 120 154 115 47 41 118 167 89 16
76 100 124 61 144 80 160 123 101 23 120 64 95 132 90
108 66 55 75 40 73 128 32 100 115 132 141 105 171 102
122 120 23 118 1 167 18 161 162 119 }
_MSG[9]: {4}{10398}{110}{ 169 3 115 121 108 38 129 63 59 132
172 131 72 71 115 20 8 107 146 77 50 176 100 77 134 117
141 170 7 71 116 176 126 51 169 107 90 171 42 21 123 34
152 68 105 140 88 166 119 106 63 41 154 35 170 109 152
132 151 32 75 87 80 22 138 70 1 100 61 43 121 56 77
146 124 55 158 32 93 97 11 28 11 165 63 1 146 87 133
169 119 29 76 20 103 87 142 156 59 75 19 1 131 148 19
76 75 177 160 168 }
_MSG[10]: {3}{15268}{166}{ 141 110 56 61 3 41 12 38 45 91
36 170 162 86 159 98 23 88 64 4 135 102 99 46 86 157
80 71 50 66 47 11 48 155 72 103 69 136 142 114 47 50
156 30 136 136 0 160 96 64 36 103 39 136 149 125 165 50
68 35 168 167 47 37 143 171 140 32 128 102 18 47 153
175 129 109 131 130 141 47 14 178 150 53 134 171 50 119
93 171 155 82 158 74 119 121 117 79 25 117 54 44 165 27
91 114 8 94 64 150 13 131 148 35 56 154 26 107 145 120
150 172 22 128 66 13 122 56 92 147 173 146 63 158 45
154 145 106 120 29 76 133 32 96 168 89 122 15 68 87 7
38 80 81 38 18 94 160 74 58 0 68 25 115 98 122 }
_MSG[11]: {3}{15268}{166}{ 141 110 56 61 3 41 12 38 45 91
36 170 162 86 159 98 23 88 64 4 135 102 99 46 86 157
80 71 50 66 47 11 48 155 72 103 69 136 142 114 47 50
156 30 136 136 0 160 96 64 36 103 39 136 149 125 165 50
68 35 168 167 47 37 143 171 140 32 128 102 18 47 153
175 129 109 131 130 141 47 14 178 150 53 134 171 50 119
93 171 155 82 158 74 119 121 117 79 25 117 54 44 165 27
91 114 8 94 64 150 13 131 148 35 56 154 26 107 145 120
150 172 22 128 66 13 122 56 92 147 173 146 63 158 45
154 145 106 120 29 76 133 32 96 168 89 122 15 68 87 7
38 80 81 38 18 94 160 74 58 0 68 25 115 98 122 }

```

You Can Enter Your Choice:

Producer Pthread_0 ADDED MSG

Consumer_0_Pthread Processed MSG:

```

{1}{7810}{82}{ 106 34 146 84 61 55 66 131 120 176 78 89
11 108 113 171 83 98 159 21 171 177 143 71 11 26 13 62
92 147 154 18 1 120 154 115 47 41 118 167 89 16 76 100
124 61 144 80 160 123 101 23 120 64 95 132 90 108 66 55
75 40 73 128 32 100 115 132 141 105 171 102 122 120 23
118 1 167 18 161 162 119 }

```

Producer Pthread_1 ADDED MSG

Producer Pthread_2 ADDED MSG

d

Last created Producer is successfully deleted. 2 Producers left

You Can Enter Your Choice:

d

Last created Producer is successfully deleted. 1 Producers left

You Can Enter Your Choice:

d

Last created Producer is successfully deleted. 0 Producers left

You Can Enter Your Choice:

d

No Producers to delete

You Can Enter Your Choice:

Consumer_0_ Pthread Processed MSG:

```
{4}{10398}{110}{ 169  3 115 121 108 38 129 63 59 132 172
131 72 71 115 20 8 107 146 77 50 176 100 77 134 117 141
170 7 71 116 176 126 51 169 107 90 171 42 21 123 34 152
68 105 140 88 166 119 106 63 41 154 35 170 109 152 132
151 32 75 87 80 22 138 70 1 100 61 43 121 56 77 146
124 55 158 32 93 97 11 28 11 165 63 1 146 87 133 169
119 29 76 20 103 87 142 156 59 75 19 1 131 148 19 76
75 177 160 168 }
```

e

Last created Consumer is successfully deleted. 0 Consumers left

You Can Enter Your Choice:

e

No Consumers to delete

You Can Enter Your Choice:

e

No Consumers to delete

You Can Enter Your Choice:

e

No Consumers to delete

You Can Enter Your Choice:

l

Head&Tail inds:[10][2]

```
_MSG[10]: {3}{15268}{166}{ 141 110 56 61 3 41 12 38 45 91
36 170 162 86 159 98 23 88 64 4 135 102 99 46 86 157
80 71 50 66 47 11 48 155 72 103 69 136 142 114 47 50
156 30 136 136 0 160 96 64 36 103 39 136 149 125 165 50
68 35 168 167 47 37 143 171 140 32 128 102 18 47 153
175 129 109 131 130 141 47 14 178 150 53 134 171 50 119
```



```

93 171 155 82 158 74 119 121 117 79 25 117 54 44 165 27
91 114 8 94 64 150 13 131 148 35 56 154 26 107 145 120
150 172 22 128 66 13 122 56 92 147 173 146 63 158 45
154 145 106 120 29 76 133 32 96 168 89 122 15 68 87 7
38 80 81 38 18 94 160 74 58 0 68 25 115 98 122 }
_MSGG[11]: {3}{15268}{166}{ 141 110 56 61 3 41 12 38 45 91
36 170 162 86 159 98 23 88 64 4 135 102 99 46 86 157
80 71 50 66 47 11 48 155 72 103 69 136 142 114 47 50
156 30 136 136 0 160 96 64 36 103 39 136 149 125 165 50
68 35 168 167 47 37 143 171 140 32 128 102 18 47 153
175 129 109 131 130 141 47 14 178 150 53 134 171 50 119
93 171 155 82 158 74 119 121 117 79 25 117 54 44 165 27
91 114 8 94 64 150 13 131 148 35 56 154 26 107 145 120
150 172 22 128 66 13 122 56 92 147 173 146 63 158 45
154 145 106 120 29 76 133 32 96 168 89 122 15 68 87 7
38 80 81 38 18 94 160 74 58 0 68 25 115 98 122 }
_MSGG[12]: {4}{1362}{9}{ 171 138 158 144 166 150 134 142 159
}
_MSGG[0]: {7}{5421}{64}{ 25 126 96 155 20 73 107 37 27 119
25 150 131 13 139 122 3 87 127 145 58 125 16 23 33 12
162 79 132 46 177 29 44 145 5 64 38 164 101 65 155 179
36 106 12 47 101 15 134 48 161 64 174 49 87 79 113 69
159 65 116 28 147 32 }
_MSGG[1]: {7}{5421}{64}{ 25 126 96 155 20 73 107 37 27 119
25 150 131 13 139 122 3 87 127 145 58 125 16 23 33 12
162 79 132 46 177 29 44 145 5 64 38 164 101 65 155 179
36 106 12 47 101 15 134 48 161 64 174 49 87 79 113 69
159 65 116 28 147 32 }

```

You Can Enter Your Choice:

s

---Messages Buff Stats---

Number of Messages in buffer:5

Max Number of Messages:13

Number of Added messages:41

Number of Processed Messages:36

---No Working Producers---

---No Working Consumers---

You Can Enter Your Choice:

q

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3.2 Тест второй программы

Для теста необходимо использовать два экземпляра программы. Ниже представлены результаты работы первого экземпляра.

[niks0@fedora oslab7]\$./oslab72

s - Show menu

l - Get List of Datas from file
a - Add Datas to file
c - Choose Data
i - Information about Chosen Student
m - Modify Chosen Data
d - Save Modified Data
q - Quit

You Can Enter Your Choice:

l

File "students_datas.bin" Opening ERROR

You Can Enter Your Choice:

a

Datas are successfully added. Current num of records in file is 12

You Can Enter Your Choice:

l

List of records in file "students_datas.bin"

1 -- Name: "Charnavok Anastasia" | Addres: "Minsk" | Semester: "4"
2 -- Name: "Arendaruk Vladislav" | Addres: "Riga" | Semester: "8"
3 -- Name: "Gumnenkova Maria" | Addres: "Vitebsk" | Semester: "4"
4 -- Name: "Maskalev Alexey" | Addres: "Minsk" | Semester: "6"
5 -- Name: "Shulia Danila" | Addres: "City Minsk" | Semester: "4"
6 -- Name: "Dorovko Yaroslav" | Addres: "Grodno" | Semester: "3"
7 -- Name: "Nikitenko Anastasia" | Addres: "Polotsk" | Semester: "4"
8 -- Name: "Ososhnik Anastasia" | Addres: "Vitebsk" | Semester: "6"
9 -- Name: "Kapustina Maria" | Addres: "Vitebsk" | Semester: "8"
10 -- Name: "Ogurchenok Kirill" | Addres: "Vitebsk" | Semester: "5"
11 -- Name: "Yukhnevich Hanna" | Addres: "Moscow" | Semester: "4"
12 -- Name: "Starikhov Zachar" | Addres: "Gorodok" | Semester: "4"

You Can Enter Your Choice:

c

Num of records in file "students_datas.bin" is 12.

Enter index of needed record: 11

Chosen data for modifying:

Stud_11: Name: "Yukhnevich Hanna" | Addres: "Moscow" | Semester: "4"

You Can Enter Your Choice:

m

Chosen data for modifying:

Stud_11: Name: "Yukhnevich Hanna" | Addres: "Moscow" | Semester: "4"

Choose field for modifying:

1 -- Name
2 -- Address
3 -- Semester

1

Enter new student name:

Annyaa 1234

Student name is redacted

You Can Enter Your Choice:

i

Old data for modifying:

Stud_11: Name: "Yukhnevich Hanna" | Addres: "Moscow" | Semester: "4"

Modified Data:

Stud_11: Name: "Annyaa 1234" | Addres: "Moscow" | Semester: "4"

You Can Enter Your Choice:

d

Lock on entered record is determined. Saving data process...

New record info is successfully saved

You Can Enter Your Choice:

q

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Ниже представлены результаты работы второго экземпляра.

[niks0@fedora oslab7]\$./oslab72

s - Show menu
l - Get List of Datas from file
a - Add Datas to file
c - Choose Data
i - Information about Chosen Student
m - Modify Chosen Data
d - Save Modified Data
q - Quit

You Can Enter Your Choice:

l

List of records in file "students_datas.bin"

1 -- Name: "Charnavok Anastasia" | Addres: "Minsk" | Semester: "4"
2 -- Name: "Arendaruk Vladislav" | Addres: "Riga" | Semester: "8"
3 -- Name: "Gumnenkova Maria" | Addres: "Vitebsk" | Semester: "4"
4 -- Name: "Maskalev Alexey" | Addres: "Minsk" | Semester: "6"
5 -- Name: "Shulia Danila" | Addres: "City Minsk" | Semester: "4"
6 -- Name: "Dorovko Yaroslav" | Addres: "Grodno" | Semester: "3"
7 -- Name: "Nikitenko Anastasia" | Addres: "Polotsk" | Semester: "4"
8 -- Name: "Ososhnik Anastasia" | Addres: "Vitebsk" | Semester: "6"
9 -- Name: "Kapustina Maria" | Addres: "Vitebsk" | Semester: "8"
10 -- Name: "Ogurchenok Kirill" | Addres: "Vitebsk" | Semester: "5"
11 -- Name: "Yukhnevich Hanna" | Addres: "Moscow" | Semester: "4"
12 -- Name: "Starikhov Zachar" | Addres: "Gorodok" | Semester: "4"

You Can Enter Your Choice:

c

Num of records in file "students_datas.bin" is 12.
Enter index of needed record: 11

Chosen data for modifying:

Stud_11: Name: "Yukhnevich Hanna" | Addres: "Moscow" | Semester: "4"

You Can Enter Your Choice:

i

Chosen data:

Stud_11: Name: "Yukhnevich Hanna" | Addres: "Moscow" | Semester: "4"
Wasn't modified.

You Can Enter Your Choice:

m

Chosen data for modifying:

Stud_11: Name: "Yukhnevich Hanna" | Addres: "Moscow" | Semester: "4"

Choose field for modifying:

- 1 -- Name
- 2 -- Address
- 3 -- Semester

2

Enter new student address:

Misk 5543233

Student address is redacted

You Can Enter Your Choice:

i

Old data for modifying:

Stud_11: Name: "Yukhnevich Hanna" | Addres: "Moscow" | Semester: "4"

Modified Data:

Stud_11: Name: "Yukhnevich Hanna" | Addres: "Misk 5543233" | Semester:
"4"

You Can Enter Your Choice:

d

Entered data is locked. Try later please

You Can Enter Your Choice:

d

Lock on entered record is determined. Saving data process...

Chosen record has been changed in other program.
Your modifications have been canceled.

You Can Enter Your Choice:

i

Chosen data:

Stud_11: Name: "Annyaa 1234" | Addres: "Moscow" | Semester: "4"

Wasn't modified.

You Can Enter Your Choice:

m

Chosen data for modifying:

Stud_11: Name: "Annyaa 1234" | Addres: "Moscow" | Semester: "4"

Choose field for modifying:

- 1 -- Name
- 2 -- Address
- 3 -- Semester

2

Enter new student address:

Misk 554

Student address is redacted

You Can Enter Your Choice:

d

Lock on entered record is determined. Saving data process...

New record info is successfully saved

You Can Enter Your Choice:

l

List of records in file "students_datas.bin"

- 1 -- Name: "Charnavok Anastasia" | Addres: "Minsk" | Semester: "4"
- 2 -- Name: "Arendaruk Vladislav" | Addres: "Riga" | Semester: "8"
- 3 -- Name: "Gumnenkova Maria" | Addres: "Vitebsk" | Semester: "4"
- 4 -- Name: "Maskalev Alexey" | Addres: "Minsk" | Semester: "6"
- 5 -- Name: "Shulia Danila" | Addres: "City Minsk" | Semester: "4"
- 6 -- Name: "Dorovko Yaroslav" | Addres: "Grodno" | Semester: "3"
- 7 -- Name: "Nikitenko Anastasia" | Addres: "Polotsk" | Semester: "4"
- 8 -- Name: "Ososhnik Anastasia" | Addres: "Vitebsk" | Semester: "6"
- 9 -- Name: "Kapustina Maria" | Addres: "Vitebsk" | Semester: "8"
- 10 -- Name: "Ogurchenok Kirill" | Addres: "Vitebsk" | Semester: "5"
- 11 -- Name: "Annyaa 1234" | Addres: "Misk 554" | Semester: "4"
- 12 -- Name: "Starikhov Zachar" | Addres: "Gorodok" | Semester: "4"

You Can Enter Your Choice:

q

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4 ВЫВОДЫ

В процессе выполнения лабораторной работы было написано две программы, одна из которых порождает потоки производители и потребители, синхронно взаимодействующие между собой, а вторая реализует возможность конкурентного доступа к файлу.