

Net-Centric Lab 2

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Question 1: Character Frequency

main.go:

```
1  package main
2
3  import (
4      "fmt"
5      "os"
6      "strings"
7      "sync"
8  )
9
10 func count(word string, resultChan chan<- map[rune]int, wg *sync.WaitGroup) {
11     defer wg.Done()
12     counts := make(map[rune]int)
13     for _, r := range word {
14         counts[r]++
15     }
16     resultChan <- counts
17 }
18
19 func main() {
20     var wg sync.WaitGroup
21     data, err := os.ReadFile("file.txt")
22     if err != nil {
23         fmt.Println("Error reading file:", err)
24         return
25     }
26     str := strings.ToLower(string(data))
27     words := strings.Fields(str) // Use Fields to split by any whitespace
28
29     wordChan := make(chan map[rune]int, len(words)) // Buffered channel
30
31     wg.Add(len(words))
32     for _, word := range words {
33         go count(word, wordChan, &wg)
34     }
35
36     go func() {
37         wg.Wait()
38         close(wordChan)
39     }()
40 }
```

```

41     result := make(map[rune]int)
42     blankCount := strings.Count(string(data), " ")
43     for wordCounts := range wordChan {
44         for key, value := range wordCounts {
45             result[key] += value
46         }
47     }
48
49     if blankCount > 0 {
50         result[' '] = blankCount
51     }
52
53     for key, value := range result {
54         if key == ' ' {
55             fmt.Printf("<blank>: %d\n", value)
56         } else {
57             fmt.Printf("%c: %d\n", key, value)
58         }
59     }
60 }
61

```

Result:

```

● PS E:\IU\Senior\Net-Centric Lab\Lab2\Q1> go run main.go
Data read from file: Net-Centric Programming
○ -: 1
  c: 2
  g: 2
  a: 1
  i: 2
  n: 3
  p: 1
  r: 3
  <blank>: 1
  o: 1
  m: 2
  e: 2
  t: 2

```

Question 2:

main.go:

```
1  package main
2
3  import (
4      "fmt"
5      "math/rand"
6      "sync"
7      "time"
8  )
9
10 const (
11     maxStudents    = 30
12     totalStudents  = 100
13     maxReadingTime = 4
14 )
15
16 // Student represents a student in the library
17 type Student struct {
18     id    int
19     time int
20 }
21
22 func main() {
23     // Capture the start time
24     startTime := time.Now()
25
26     // Create a channel to store students
27     students := make(chan Student, maxStudents)
28     // Create a wait group to wait for all students to finish
29     var wg sync.WaitGroup
30
31     // Create a map to track assigned IDs
32     assignedIDs := make(map[int]bool)
33
34     // Create a goroutine for each student
35     for i := 0; i < totalStudents; i++ {
36         time.Sleep(time.Second)
37         duration := rand.Intn(maxReadingTime) + 1
38     }
```

```

39 // Generate a unique random ID
40 var id int
41 for {
42     id = rand.Intn(totalStudents) + 1
43     if !assignedIDs[id] {
44         assignedIDs[id] = true
45         break
46     }
47 }
48
49 student := Student{
50     id: id,
51     time: duration,
52 }
53
54 // Add the student to the wait group
55 wg.Add(1)
56 go func(s Student) {
57     defer wg.Done()
58     // Check if the channel is full
59     select {
60     case students <- s:
61         openingTime := time.Since(startTime).Seconds() - 1
62         fmt.Printf("Time %.0f: Student %d starts reading at the library\n", openingTime, s.id)
63         time.Sleep(time.Second * time.Duration(s.time))
64         openingTime = time.Since(startTime).Seconds() - 1
65         fmt.Printf("Time %.0f: Student %d leaves the library with %d hours\n", openingTime, s.id, s.time)
66         <-students
67     default:
68         openingTime := time.Since(startTime).Seconds() - 1
69         fmt.Printf("Time %.0f: Student %d is waiting to enter the library\n", openingTime, s.id)
70         students <- s
71         openingTime = time.Since(startTime).Seconds() - 1
72         fmt.Printf("Time %.0f: Student %d starts reading at the library\n", openingTime, s.id)
73         time.Sleep(time.Second * time.Duration(s.time))
74         openingTime = time.Since(startTime).Seconds() - 1
75         fmt.Printf("Time %.0f: Student %d leaves the library with %d hours\n", openingTime, s.id, s.time)
76         <-students
77     }
78 }(student)
79 }

```

```

81 go func() {
82     wg.Wait()
83     close(students)
84 }()
85
86 wg.Wait()
87 openingTime := time.Since(startTime).Seconds()
88 fmt.Printf("Time %.0f: No more students. Lets call it a day\n", openingTime)
89 }
90

```

Result:

```
PS E:\IU\Senior\Net-Centric Lab\Lab2\Q2> go run main.go
Time 0: Student 90 starts reading at the library
Time 1: Student 35 starts reading at the library
Time 2: Student 68 starts reading at the library
Time 3: Student 90 leaves the library with 3 hours
Time 3: Student 6 starts reading at the library
Time 4: Student 35 leaves the library with 3 hours
Time 4: Student 27 starts reading at the library
Time 4: Student 6 leaves the library with 1 hours
Time 4: Student 68 leaves the library with 2 hours
Time 5: Student 79 starts reading at the library
Time 6: Student 93 starts reading at the library
Time 7: Student 27 leaves the library with 3 hours
Time 7: Student 47 starts reading at the library
Time 8: Student 47 leaves the library with 1 hours
Time 8: Student 13 starts reading at the library
Time 9: Student 79 leaves the library with 4 hours
Time 9: Student 93 leaves the library with 3 hours
Time 9: Student 44 starts reading at the library
Time 10: Student 13 leaves the library with 2 hours
Time 10: Student 44 leaves the library with 1 hours
Time 10: Student 72 starts reading at the library
Time 11: Student 76 starts reading at the library
Time 12: Student 91 starts reading at the library
Time 13: Student 72 leaves the library with 3 hours
Time 13: Student 84 starts reading at the library
Time 14: Student 94 starts reading at the library
Time 14: Student 91 leaves the library with 2 hours
Time 15: Student 76 leaves the library with 4 hours
Time 15: Student 1 starts reading at the library
Time 16: Student 94 leaves the library with 2 hours
Time 16: Student 84 leaves the library with 3 hours
Time 16: Student 99 starts reading at the library
Time 17: Student 82 starts reading at the library
Time 18: Student 83 starts reading at the library
Time 19: Student 1 leaves the library with 4 hours
Time 19: Student 67 starts reading at the library
Time 19: Student 82 leaves the library with 2 hours
Time 20: Student 99 leaves the library with 4 hours
Time 20: Student 10 starts reading at the library
Time 20: Student 83 leaves the library with 2 hours
Time 21: Student 49 starts reading at the library
Time 22: Student 49 leaves the library with 1 hours
Time 22: Student 57 starts reading at the library
Time 23: Student 67 leaves the library with 4 hours
Time 23: Student 10 leaves the library with 3 hours
Time 23: Student 42 starts reading at the library
Time 24: Student 17 starts reading at the library
Time 24: Student 42 leaves the library with 1 hours
Time 25: Student 17 leaves the library with 1 hours
Time 25: Student 36 starts reading at the library
Time 26: Student 57 leaves the library with 4 hours
Time 26: Student 25 starts reading at the library
Time 27: Student 12 starts reading at the library
Time 28: Student 36 leaves the library with 3 hours
Time 28: Student 12 leaves the library with 1 hours
```

- Time 29: Student 98 starts reading at the library
- Time 30: Student 25 leaves the library with 4 hours
- Time 30: Student 11 starts reading at the library
- Time 31: Student 11 leaves the library with 1 hours
- Time 31: Student 55 starts reading at the library
- Time 32: Student 85 leaves the library with 4 hours
- Time 32: Student 77 starts reading at the library
- Time 32: Student 55 leaves the library with 1 hours
- Time 33: Student 74 starts reading at the library
- Time 33: Student 98 leaves the library with 4 hours
- Time 34: Student 64 starts reading at the library
- Time 34: Student 77 leaves the library with 2 hours
- Time 35: Student 16 starts reading at the library
- Time 35: Student 74 leaves the library with 2 hours
- Time 36: Student 16 leaves the library with 1 hours
- Time 36: Student 37 starts reading at the library
- Time 37: Student 63 starts reading at the library
- Time 38: Student 64 leaves the library with 4 hours
- Time 38: Student 5 starts reading at the library
- Time 39: Student 80 starts reading at the library
- Time 39: Student 63 leaves the library with 2 hours
- Time 40: Student 37 leaves the library with 4 hours
- Time 40: Student 24 starts reading at the library
- Time 41: Student 5 leaves the library with 3 hours
- Time 41: Student 80 leaves the library with 2 hours
- Time 41: Student 52 starts reading at the library
- Time 42: Student 96 starts reading at the library
- Time 43: Student 96 leaves the library with 1 hours
- Time 43: Student 48 starts reading at the library
- Time 43: Student 52 leaves the library with 2 hours
- Time 44: Student 59 starts reading at the library
- Time 44: Student 24 leaves the library with 4 hours
- Time 44: Student 48 leaves the library with 1 hours
- Time 45: Student 70 starts reading at the library
- Time 46: Student 70 leaves the library with 1 hours
- Time 46: Student 59 leaves the library with 2 hours
- Time 46: Student 53 starts reading at the library
- Time 47: Student 2 starts reading at the library
- Time 48: Student 21 starts reading at the library
- Time 48: Student 53 leaves the library with 2 hours
- Time 48: Student 2 leaves the library with 1 hours
- Time 49: Student 45 starts reading at the library
- Time 50: Student 9 starts reading at the library
- Time 51: Student 45 leaves the library with 2 hours
- Time 51: Student 21 leaves the library with 3 hours
- Time 51: Student 46 starts reading at the library
- Time 52: Student 9 leaves the library with 2 hours
- Time 52: Student 19 starts reading at the library
- Time 52: Student 46 leaves the library with 1 hours
- Time 53: Student 56 starts reading at the library
- Time 53: Student 19 leaves the library with 1 hours
- Time 54: Student 7 starts reading at the library
- Time 55: Student 54 starts reading at the library
- Time 56: Student 56 leaves the library with 3 hours
- Time 56: Student 78 starts reading at the library
- Time 57: Student 89 starts reading at the library

Time 58: Student 81 starts reading at the library
Time 59: Student 54 leaves the library with 4 hours
Time 59: Student 89 leaves the library with 2 hours
Time 59: Student 86 starts reading at the library
Time 60: Student 78 leaves the library with 4 hours
Time 60: Student 71 starts reading at the library
Time 61: Student 26 starts reading at the library
Time 62: Student 81 leaves the library with 4 hours
Time 62: Student 29 starts reading at the library
Time 63: Student 60 starts reading at the library
Time 63: Student 86 leaves the library with 4 hours
Time 63: Student 71 leaves the library with 3 hours
Time 64: Student 33 starts reading at the library
Time 64: Student 26 leaves the library with 3 hours
Time 65: Student 60 leaves the library with 2 hours
Time 65: Student 29 leaves the library with 3 hours
Time 65: Student 69 starts reading at the library
Time 66: Student 22 starts reading at the library
Time 67: Student 22 leaves the library with 1 hours
Time 67: Student 66 starts reading at the library
Time 67: Student 69 leaves the library with 2 hours
Time 68: Student 33 leaves the library with 4 hours
Time 68: Student 58 starts reading at the library
Time 68: Student 66 leaves the library with 1 hours
Time 69: Student 61 starts reading at the library
Time 70: Student 58 leaves the library with 2 hours
Time 70: Student 61 leaves the library with 1 hours
Time 70: Student 43 starts reading at the library
Time 71: Student 95 starts reading at the library
Time 72: Student 14 starts reading at the library
Time 73: Student 28 starts reading at the library
Time 74: Student 43 leaves the library with 4 hours
Time 74: Student 51 starts reading at the library
Time 75: Student 95 leaves the library with 4 hours
Time 75: Student 14 leaves the library with 3 hours
Time 75: Student 51 leaves the library with 1 hours
Time 75: Student 50 starts reading at the library
Time 76: Student 31 starts reading at the library
Time 77: Student 50 leaves the library with 2 hours
Time 77: Student 100 starts reading at the library
Time 77: Student 28 leaves the library with 4 hours
Time 78: Student 15 starts reading at the library
Time 78: Student 31 leaves the library with 2 hours
Time 79: Student 8 starts reading at the library
Time 80: Student 87 starts reading at the library
Time 80: Student 8 leaves the library with 1 hours
Time 80: Student 100 leaves the library with 3 hours
Time 81: Student 65 starts reading at the library
Time 82: Student 15 leaves the library with 4 hours
Time 82: Student 87 leaves the library with 2 hours
Time 82: Student 62 starts reading at the library
Time 83: Student 65 leaves the library with 2 hours
Time 83: Student 62 leaves the library with 1 hours
Time 83: Student 20 starts reading at the library
Time 84: Student 4 starts reading at the library
Time 85: Student 4 leaves the library with 1 hours
Time 85: Student 20 leaves the library with 2 hours
Time 85: Student 92 starts reading at the library

Time 86: Student 88 starts reading at the library
Time 87: Student 92 leaves the library with 2 hours
Time 87: Student 97 starts reading at the library
Time 88: Student 41 starts reading at the library
Time 89: Student 38 starts reading at the library
Time 90: Student 88 leaves the library with 4 hours
Time 90: Student 97 leaves the library with 3 hours
Time 90: Student 38 leaves the library with 1 hours
Time 90: Student 41 leaves the library with 2 hours
Time 90: Student 39 starts reading at the library
Time 91: Student 23 starts reading at the library
Time 92: Student 75 starts reading at the library
Time 93: Student 39 leaves the library with 3 hours
Time 93: Student 34 starts reading at the library
Time 94: Student 40 starts reading at the library
Time 94: Student 23 leaves the library with 3 hours
Time 95: Student 30 starts reading at the library
Time 95: Student 40 leaves the library with 1 hours
Time 95: Student 34 leaves the library with 2 hours
Time 96: Student 75 leaves the library with 4 hours
Time 96: Student 30 leaves the library with 1 hours
Time 96: Student 32 starts reading at the library
Time 97: Student 73 starts reading at the library
Time 98: Student 18 starts reading at the library
Time 99: Student 3 starts reading at the library
Time 99: Student 32 leaves the library with 3 hours
Time 100: Student 18 leaves the library with 2 hours
Time 101: Student 73 leaves the library with 4 hours
Time 103: Student 3 leaves the library with 4 hours
Time 104: No more students. Lets call it a day