

C Programming II

2020 Spring

Midterm

Instructor: Po-Wen Chi

Due: 2020.04.22 PM 15:30

Policies:

- Offline test unless you complete the exam and want to submit your code.
- Do not forget to include your Makefile. TA will only use the command `make` to build your program. If `make` fails, you will get zero points and no room for bargaining. So if you do not know how to solve a problem, please, do not include it in your Makefile.
- I do not care your source code file names, but the executive binary names should be **mid01**, **mid02**, **mid03**, **mid04**.
- You can ask TA if you do not understand the problems.

1 Rational Number Arithmetic Part 3 (30 pts)

In your homework, I have asked you to develop a rational number calculator. Now, please enhance your program to support mixed fractions. A mixed fraction is a traditional denotation of the sum of an integer and a proper fraction. There are some examples:

$$1\frac{5}{7}, -3\frac{2}{9} \dots$$

These mixed fractions are denoted as $(1, 5, 7), (-3, 2, 9)$ respectively. Please write a program to calculate the result of a given equation. You need to support **addition +**, **subtraction -**, **multiplication ***, **division /**. Of course, you must follow arithmetic operation precedence. For simplicity, you do not need to consider parentheses. Your answer must follows the following rules. Given $a\frac{b}{c}$,

- $|c| > |b|$.
- $\frac{b}{c}$ must be the reduced form.
- b can be a negative integer only when $a = 0$.

- c must be a positive integer.
- 0 is presented as (0,0,0). Except the case of zero, c cannot be 0.

There is an example. If a user wants to get the result of the following equation:

$$\frac{1}{2} + 1\frac{5}{6} \times 2\frac{3}{10} = 4\frac{43}{60}$$

```
1 $ ./mid01
2 (0,1,2) + (1,5 , 6) * (2, 3 , 10 )
3 (4,43,60)
```

2 BMP: Less Colors (30 pts)

Digital images consist out of pixels. If we want to store or transmit an image, we have to provide information about each individual pixel. A common representation of color information is to use 3 bytes to represent RED, GREEN, BLUE respectively. This is what I have shown you in this class. However, when I was young, we did not use 3 bytes to present a pixel. Instead, we preferred to use **2 bytes** to present one pixel. So there are only 65535 possible colors. How to represent 3 colors in only 2 bytes? We use 5 bits for Red and Blue and 6 bits for Green. The transformation is presented in figure 1. Note that since we have less bits (information) available, we can represent less colors.

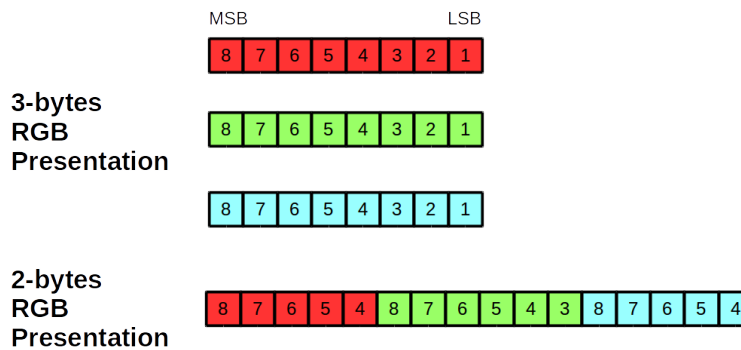


Figure 1: Color Transformation.

For your reference, I provide you BMP wikipedia and two BMP files, one is 3-bytes presentation and the other is 2-bytes presentation. Your program should be

```
1 $ ./mid02
2 Please enter the input image name: maldives.bmp
3 Please enter the output image name: maldives_16.bmp
4 Done!
```

Note that the user may input a file which is not a BMP file, you need to give a warning. How to check if the input is a BMP file? Read the first two bytes.

3 Version Control Analyzer (40 pts)

In most software version control systems, when a user commits a code, the system will notify all users about this change. Email is a common notification approach. Now I will give you an email record, **mbox-short.txt**, about the subversion notification. Subversion (often abbreviated SVN, after its command name svn) is a software versioning and revision control system distributed as open source under the Apache License. OK, I know most of you use Git but I am an old guy.

Now let's me teach you how to interpret the file. Figure 2 and Figure 3 are descriptions.

```
From: stephen.marquard@uct.ac.za Sat Jan  5 09:14:16 2008
Return-Path: <postmaster@collab.sakaiproject.org>
Received: from murder (mail.umich.edu [141.211.14.90])
    by frankenstein.mail.umich.edu (Cyrus v2.3.8) with LMTPA;
    Sat, 05 Jan 2008 09:14:16 -0500
X-Sieve: CMU Sieve 2.3
Received: from murder (unix socket)
    by mail.umich.edu (Cyrus v2.2.12) with LMTPA;
    Sat, 05 Jan 2008 09:14:16 -0500
Received: from holes.mr.itd.umich.edu (holes.mr.itd.umich.edu [141.211.14.79])
    by flawless.mail.umich.edu () with ESMTP id m05EEFR1013674;
    Sat, 5 Jan 2008 09:14:15 -0500
Received: FROM paploo.uhi.ac.uk (app1.prod.collab.uhi.ac.uk [194.35.219.184])
    BY holes.mr.itd.umich.edu ID 477F90B0.2DB2F.12494 ;
    5 Jan 2008 09:14:10 -0500
Received: from paploo.uhi.ac.uk (localhost [127.0.0.1])
    by paploo.uhi.ac.uk (Postfix) with ESMTP id 5F919BC2F2;
    Sat, 5 Jan 2008 14:10:05 +0000 (GMT)
Message-ID: <200801051412.m05ECIaH010327@nakamura.uts.iupui.edu>
Mime-Version: 1.0
Content-Transfer-Encoding: 7bit
Received: from prod.collab.uhi.ac.uk ([194.35.219.182])
    by paploo.uhi.ac.uk (JAMES SMTP Server 2.1.3) with SMTP ID 899
    for <source@collab.sakaiproject.org>;
    Sat, 5 Jan 2008 14:09:50 +0000 (GMT)
Received: from nakamura.uts.iupui.edu (nakamura.uts.iupui.edu [134.68.220.122])
    by shmi.uhi.ac.uk (Postfix) with ESMTP id A215243002
    for <source@collab.sakaiproject.org>; Sat, 5 Jan 2008 14:13:33 +0000 (GMT)
Received: from nakamura.uts.iupui.edu (localhost [127.0.0.1])
    by nakamura.uts.iupui.edu (8.12.11.20060308/8.12.11) with ESMTP id m05ECJvp010329
    for <source@collab.sakaiproject.org>; Sat, 5 Jan 2008 09:12:19 -0500
Received: (from apache@localhost)
    by nakamura.uts.iupui.edu (8.12.11.20060308/8.12.11/Submit) id m05ECIaH010327
    for source@collab.sakaiproject.org; Sat, 5 Jan 2008 09:12:18 -0500
```

**Not Important.
Please Ignore!!**

Figure 2: How to interpret mbox: SVN record 01.

```
Date: Sat, 5 Jan 2008 09:12:18 -0500
X-Authentication-Warning: nakamura.uts.iupui.edu: apache set sender to stephen.marquard@uct.ac.za using
-I
To: source@collab.sakaiproject.org
From: stephen.marquard@uct.ac.za
Subject: [sakai] svn commit: r39772 - content/branches/sakai_2-5-x/content-impl/impl/src/java/org/sakaiproject/content/impl
X-Content-Type-Outer-Envelope: text/plain; charset=UTF-8
X-Content-Type-Message-Body: text/plain; charset=UTF-8
Content-Type: text/plain; charset=UTF-8
X-DSPAM-Result: Innocent
X-DSPAM-Processed: Sat Jan  5 09:14:16 2008
X-DSPAM-Confidence: 0.8475
X-DSPAM-Probability: 0.0000

Details: http://source.sakaiproject.org/viewsvn.php?rev=39772

Author: stephen.marquard@uct.ac.za
Date: 2008-01-05 09:12:07 -0500 (Sat, 05 Jan 2008)
New Revision: 39772

Modified:
  content/branches/sakai_2-5-x/content-impl/impl/src/java/org/sakaiproject/content/impl/ContentServiceSqlOracle.java
  content/branches/sakai_2-5-x/content-impl/impl/src/java/org/sakaiproject/content/impl/DbContentService.java
Log:
  SAK-12501 merge to 2-5-x: r39622, r39624:5, r39632:3 (resolve conflict from differing linebreaks for r39622)

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This automatic notification message was sent by Sakai Collab (https://collab.sakaiproject.org/portal) from the
Source site.
You can modify how you receive notifications at My Workspace > Preferences.
```

User Name

Commit Date

Revision Number

Commit Files

Figure 3: How to interpret mbox: SVN record 02.

Please write a program to read this file and answer the following questions:

```
1 $ ./mid03
2 Please enter the mbox file: mbox-short.txt
3 1) Who commits most?
4 2) Who commits most in 20:00-24:00 ?
5 3) What New revision change the most files?
6 4) New revision --> user
7 5) Exit.
8 Your Choice: 4
9 New Revision Number: 39754
10 Author: david.horwitz@uct.ac.za
11 Your Choice: 5
```

Note that file change includes file or directory, addition, modification and remove. Some records are Revision, not New Revision, and they can be ignored.

For your convenience, the user number is less than 64.

4 Bonus: Your Comments (5 pts)

Again, any comments are welcomed. However, you will get nothing if you leave this question blank.