Birla Institute of Technology and Science, Pilani
End-semester examination

Programming for Analytics
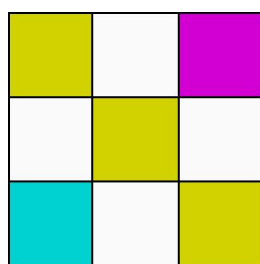MPBA G507

Total marks : 140

Time : 2:00 pm - 5:00 pm

Attempt all 21 questions

Instructions: All questions are short answer type questions, there are no marks for writing the intermediary steps or process or theory. Only write the exact output as asked in the questions.

Question number 1 to 10 are based on image manipulation, it involves concepts of layering and kernel convolution. Input is a 3 X 3 pixel image, consisting 9 pixels with the name '3x3_pixels.bmp'.

RGB channel information for each pixel is given below

Red channel matrix		
210	250	210
250	210	250
0	250	210

Green channel matrix		
210	250	0
250	210	250
210	250	210

Blue channel matrix		
0	250	210
250	0	250
210	250	0

The image undergoes following data manipulation pipeline

Image → F_1 → F_2 → F_3 → Result

R Code given below performs above mentioned manipulation

```
1.  library(bmp)
2.  library(dplyr)
3.  library(magick)
4.  library(tesseract)

5.  i1 <- "3x3_pixels.bmp" %>% read.bmp %>% f1;
6.  i1 <- magick::image_read(i1/255);
7.  i1 %>% image_write('i1.bmp','bmp');

8.  i2 <- "i1.bmp" %>% image_read %>% f2
9.  i2 %>% image_write('i2.bmp','bmp');

10. i3 <- "i2.bmp" %>% image_read %>% image_sample("20 x 20")
11. i3 %>% image_write('i3.bmp','bmp');

12. i4 <- "i3.bmp" %>% read.bmp %>% f3
13. i4 <- i4 %>% magick::image_read(255)
14. i4 %>% image_write('i4.bmp','bmp')
15. text <- i4 %>% tesseract::ocr(engine = 'eng');
16. cat(text)
```

F$_1$ function is given as glass-box for which the code is provided here

```
f1 <- function(image){
    for(i in 1:3){
        for(j in 1:3){
            image[i, j, ] <- mean(image[i,j,])
        }
    }
    return(image[,,])
}
```

F$_2$ function is black-box which performs kernel convolution with following kernel matrix

0.2	-0.1	0.2
-0.1	0.2	-0.1
0.2	-0.1	0.2

F$_3$ function is a glass-box which performs following manipulation

```
f3 <- function(image){
    nr <- nrow(image)
    nc <- ncol(image)
    for(i in 1:nr){
        for(j in 1:nc){
            if(i+j == nr+1 || i==j){
                image[i, j, ] <- 0
            }
            else
                image[i, j, ] <- 255
        }
    }
    return(image)
}
```

Questions: Marks

Q1. What above code will print (Output of cat function from line no. 15)?   5

Q2. read.bmp() function is defined in which R library?   2

Q3. image_read() function is define in which R library?   2

Q4. What will be the application of F1 function?   3

Q5. Write the value of i1[,,1] after the execution of line no. 5?   5

Q6. Write the value of i2[,,1] after the execution of line no. 8?   5

Q7. What is the total number of pixels in i3.bmp after the execution of   4
line no. 11?

Q8. How many unique pixel intensities are there in i4[,,1] matrix after   4
execution of line no. 12?

Q9. Write the value of i4[3,4,1] after the execution of line no. 12?   5

Q10. Write the value of i4[3,3,1] after the execution of line no. 12?   5

Q11. Write the Full form of ARIMA?   5

Q12. Write the output of following R code   10
```r
medals <- factor(ordered = TRUE, levels = c("E","D","C","B","A"), x =
c("A","C","C","B"))
medals <- medals[-c(1,2,4)]
medals <- fct_drop(f = medals, only = c("A","B"))
medals <- fct_expand(medals,"X")
output <- nlevels(medals) - length(medals)
rainbow(output)
```


Q13. What will be the start and end value of January time-series object   10
Use the following R code to answer the question.
```r
January <- matrix(nrow = 5, ncol = 7, data = NA);
colnames(January) <- c('Sun','Mon','Tue','Wed','Thu','Fri','Sat');
rownames(January) <- 1:5;
nc <- ncol(January)
i <- 0
for(j in 1:nrow(January)){
    for(k in 1:nc){
        if(i < 31){
        i <- i + 1
        January[j,k] <- i
        }
    }
}
January <- ts(January)
```


Q14. Write the output of last R statement (Final value of text variable).   10
```r
library(tidyverse)
library(stringi)
text <- str_c("Mr. ", c("Ramesh", "Suresh"), " Ji") %>% str_sub(1, 10) %>%
str_sub(-3, -1) %>% stri_reverse %>% stri_pad_right(6, pad='*' )
word1 <- c("Bin","Hun")
word2 <- str_sub(stri_reverse(text[1]),4,6)
text <- str_c(word1,word2)
print(text)
```


Q15. Write the output of last python statement (Final value of x variable) 10
```python
from numpy import cumsum
x = [3, 1, 2, 5, 3, 1]
x.append(max(x)-min(x)+x[3])
x.insert(max(min(x), x[3]), 0)
x.remove(0)
x.reverse()
x.sort()
x = cumsum(x)
print(x)
```

Q16. Write the output of last python statement (Final value of list1)   10
```python
list1 = [1,3,2]
list2 = list1[1:2]
list3 = list1[-3:-2]
list1 = [list2,list3,2]
list1 = list1 * 2
list2 = list1.count(3) + list1.count(2)
list3 = list1.pop(-4) + 1
list1.pop(1)
list1.pop(2)
list1.pop(1)
list1.append(list2+list3)
print(list1)
```

Q17. What will be the purpose of following R code, explain.   5
```r
while (!is.null(dev.list())) dev.off()
```

Q18. Write the output of following R code snippet   10
```r
s1 = "B\rRAC\rES\n"
s2 = "TR\bAC\bES"
cat(s1)
cat(s2)
```

Q19. Write the output of following Python code snippet   10
```python
list1 = (1,2,4,5,6)
list1[2] = 2
print(list1.count(2))
```

Q20. Write the output of following Python code snippet   10
```python
list2 = [10,20,30]
list2[3] = 30
print(list2.count(30))
```

Q21. Write whether following words are keywords or not, and in which   10
language?

	Keyword (Yes/No)	Language(R and/or Python)
is		
next		
in		
with		
del		