

ФЕДЕРАЛЬНОЕ АГЕНТСТВО СВЯЗИ
ФЕДЕРАЛЬНОЕ
ГОСУДАРСТВЕННОЕ ОБРАЗОВАТЕЛЬНОЕ БЮДЖЕТНОЕ
УЧРЕЖДЕНИЕ ВЫСШЕГО ПРОФЕССИОНАЛЬНОГО
ОБРАЗОВАНИЯ
«СИБИРСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ
ТЕЛЕКОММУНИКАЦИЙ И ИНФОРМАТИКИ»

Кафедра прикладной математики и кибернетики

Лабораторная работа №4

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Новосибирск 2024 г.

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Задание

Вывести на экран 16, 256-цветный и True Color BMP файл используя putpixel, без использования библиотек обработки графических файлов.

Листинг программы

```
import random
import math
import numpy as np
import matplotlib.pyplot as plt
from PIL import Image

BMP_HEADER_BSIZE = 14
BMP_INFO_HEADER_BSIZE = 40

class BmpFile:
    def init(self, name):
        self.name = name
        self.fileObj = None
        self.header = None
        self.infoHeader = None
        self.palette = None
        self.paletteSize = None
        self.colorCount = None
        self.bpp = None
        self.padding = None

        self.type = None
        self.size = None
        self.reserved = None
        self.offset = None

        self.infoHeaderSize = None
```

```
self.width = None
self.height = None
self.planes = None
self.depthColor = None
self.compression = None
self.compressedSize = None
self.xPixPM = None
self.yPixPM = None
self.usedColors = None
self.importantColors = None
```

```
def PrintInfo(self):
    print("-----HEADER-----")
    print(f"TYPE: {self.type}")
    print(f"FILE SIZE: {self.size}")
    print(f"RESERVED: {self.reserved}")
    print(f"DATA OFFSET: {self.offset}")
    print("-----INFO HEADER-----")
    print(f"HEADER SIZE: {self.infoHeaderSize}")
    print(f"WIDTH: {self.width}")
    print(f"HEIGHT: {self.height}")
    print(f"PLANES: {self.planes}")
    print(f"DEPTH: {self.depthColor}")
    print(f"COMPRESSION: {self.compression}")
    print(f"COMPRESSED SIZE: {self.compressedSize}")
    print(f"X RESOLUTION: {self.xPixPM}")
    print(f"Y RESOLUTION: {self.yPixPM}")
    print(f"USED COLORS: {self.usedColors}")
    print(f"IMPORTANT COLORS: {self.importantColors}")
    print()
```

```

class BmpFileReader:
    def init(self, fileName):
        self.bmpObj = BmpFile(fileName)

    def Read(self):
        self.bmpObj.fileObj = open(self.bmpObj.name, 'rb')
        self.bmpObj.header =
self.bmpObj.fileObj.read(BMP_HEADER_BSIZE)

        # HEADER

        self.bmpObj.type = self.bmpObj.header[:2].decode('utf-8')
        self.bmpObj.size = int.from_bytes(self.bmpObj.header[2:6],
'little')

        self.bmpObj.reserved =
int.from_bytes(self.bmpObj.header[6:10], 'little')

        self.bmpObj.offset = int.from_bytes(self.bmpObj.header[10:14],
'little')

        # HEADER #

        self.bmpObj.infoHeader =
self.bmpObj.fileObj.read(BMP_INFO_HEADER_BSIZE)

        # INFO HEADER

        self.bmpObj.infoHeaderSize =
int.from_bytes(self.bmpObj.infoHeader[:4], 'little')

        self.bmpObj.width =
int.from_bytes(self.bmpObj.infoHeader[4:8], 'little')

        self.bmpObj.height =
int.from_bytes(self.bmpObj.infoHeader[8:12], 'little')

        self.bmpObj.planes =
int.from_bytes(self.bmpObj.infoHeader[12:14], 'little')

        self.bmpObj.depthColor =
int.from_bytes(self.bmpObj.infoHeader[14:16], 'little')

        self.bmpObj.compression =
int.from_bytes(self.bmpObj.infoHeader[16:20], 'little')

```

```

        self.bmpObj.compressedSize =
int.from_bytes(self.bmpObj.infoHeader[20:24], 'little')

        self.bmpObj.xPixPM =
int.from_bytes(self.bmpObj.infoHeader[24:28], 'little')

        self.bmpObj.yPixPM =
int.from_bytes(self.bmpObj.infoHeader[28:32], 'little')

        self.bmpObj.usedColors =
int.from_bytes(self.bmpObj.infoHeader[32:36], 'little')

        self.bmpObj.importantColors =
int.from_bytes(self.bmpObj.infoHeader[36:40], 'little')

        # INFO HEADER #

        self.bmpObj.colorCount = pow(2, self.bmpObj.depthColor)

        self.bmpObj.paletteSize = self.bmpObj.colorCount * 4

        #self.bmpObj.palette =
self.bmpObj.fileObj.read(self.bmpObj.paletteSize)

        self.bmpObj.bpp = self.bmpObj.depthColor // 8

        self.bmpObj.padding = (4 - (self.bmpObj.width *
self.bmpObj.bpp) % 4) % 4

        return self.bmpObj.fileObj

def GenerateNewPalette(self, pixels, width, height):

    colors = {}

    for y in range(height):
        for x in range(width):

            flattenColor = (pixels[y, x][0] >> 4 << 4, pixels[y,
x][1] >> 4 << 4, pixels[y, x][2] >> 4 << 4)

            colors[flattenColor] = colors[flattenColor] + 1 if
flattenColor in colors else 1

        colors = list(colors.items())

        colors.sort(key=lambda x: x[1], reverse=False)

```

```

newPalette = []
newPalette.append(colors.pop()[0])
newColorCount = 1

while newColorCount < self.outputColorNum:
    newColor = colors.pop()[0]
    for color in newPalette:
        if 128*128*3 < self.CountDelta(color, newColor):
            newPalette.append(newColor)
            newColorCount += 1
            break
    return newPalette

row = originalFile.read((self.width + self.padding) * self.bpp)
    newFile.write(row)

    for _ in range(borderWidth):
        newFile.write(random.randint(0,
colorNum).to_bytes(self.bpp, 'little'))

        newFile.write(b'\x00' * (padding - self.padding))

    for _ in range(borderWidth):
        for _ in range(newWidth):
            newFile.write(random.randint(0,
colorNum).to_bytes(self.bpp, 'little'))
            newFile.write(b'\x00' * padding)
        def DrawOriginal(self):
with open(self.name, 'rb') as originalFile:
    originalFile.seek(self.offset)
    graphImg = None

```

```

        if (self.depthColor == 24):
            graphImg = np.zeros((self.height, self.width, 3),
dtype=np.uint8)

            for y in range(self.height - 1, -1, -1):
                for x in range(self.width):
                    blue = int.from_bytes(originalFile.read(1),
'little')

                    green = int.from_bytes(originalFile.read(1),
'little')

                    red = int.from_bytes(originalFile.read(1),
'little')

                    graphImg[y, x] = [red, green, blue]

            originalFile.read(self.padding)

        elif (self.depthColor == 8):
            graphImg = np.zeros((self.height, self.width, 3),
dtype=np.uint8)

            palette = np.frombuffer(self.palette,
dtype=np.uint8).reshape((self.colorCount, 4))

            for y in range(self.height - 1, -1, -1):
                for x in range(self.width):
                    pixel =
int.from_bytes(originalFile.read(self.bpp), 'little')
                    graphImg[y, x] = np.flip(palette[pixel, :3])

            originalFile.read(self.padding)

        elif (self.depthColor == 4):
            padding = (4 - (self.width // 2) % 4) % 4
            graphImg = np.zeros((self.height, self.width, 3),
dtype=np.uint8)

```



```

        palette = np.frombuffer(self.palette,
dtype=np.uint8).reshape((self.colorCount, 4))

        for y in range(self.height - 1, -1, -1):
            for x in range(0, self.width, 2):
                byteVal = int.from_bytes(originalFile.read(1),
'little')

                pixel1 = (byteVal >> 4) & 0x0F
                pixel2 = byteVal & 0x0F
                graphImg[y, x] = np.flip(palette[pixel1, :3])
                if x+1 < self.width:
                    graphImg[y, x + 1] =
np.flip(palette[pixel2, :3])
            originalFile.read(padding)

            plt.figure()
            plt.imshow(graphImg)
            plt.axis('off')
            return graphImg

def DrawScript():
    bmpReader = BmpFileReader('CAT16.BMP')
    bmpReader.Read()
    bmpReader.bmpObj.PrintInfo()
    #bmpReader.bmpObj.DrawOriginal()

    bmpReader1 = BmpFileReader('CAT256.BMP')
    bmpReader1.Read()
    bmpReader1.bmpObj.PrintInfo()
    #bmpReader1.bmpObj.DrawOriginal()

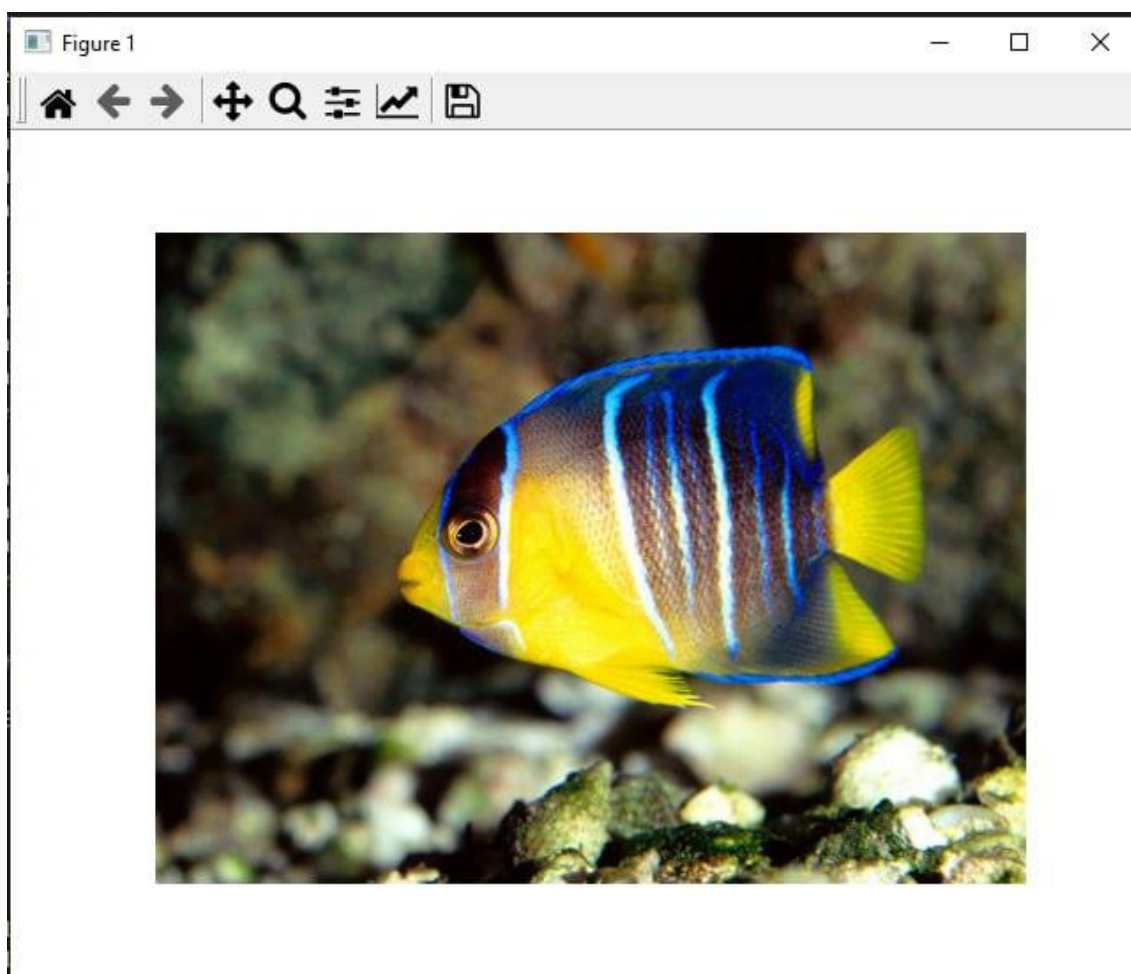
    bmpReader2 = BmpFileReader('fish.BMP')

```

```
bmpReader2.Read()  
bmpReader2.bmpObj.PrintInfo()  
bmpReader2.bmpObj.DrawOriginal()
```

```
plt.show()  
  
if name == 'main':  
    DrawScript()
```

Результат работы программы



```
PS C:\PGI> & C:/Users/Татьяна/AppData/Local/Programs/Python/Python310/python.exe
-----HEADER-----
TYPE: BM
FILE SIZE: 109558
RESERVED: 0
DATA OFFSET: 118
-----INFO HEADER-----
HEADER SIZE: 40
WIDTH: 456
HEIGHT: 480
PLANES: 1
DEPTH: 4
COMPRESSION: 0
COMPRESSED SIZE: 109440
X RESOLUTION: 0
Y RESOLUTION: 0
USED COLORS: 16
IMPORTANT COLORS: 16
```

```
-----HEADER-----
TYPE: BM
FILE SIZE: 320686
RESERVED: 0
DATA OFFSET: 1078
-----INFO HEADER-----
HEADER SIZE: 40
WIDTH: 551
HEIGHT: 579
PLANES: 1
DEPTH: 8
COMPRESSION: 0
COMPRESSED SIZE: 319608
X RESOLUTION: 0
Y RESOLUTION: 0
USED COLORS: 236
IMPORTANT COLORS: 236
```

```
-----HEADER-----
TYPE: BM
FILE SIZE: 1440054
RESERVED: 0
DATA OFFSET: 54
-----INFO HEADER-----
HEADER SIZE: 40
WIDTH: 800
HEIGHT: 600
PLANES: 1
DEPTH: 24
COMPRESSION: 0
COMPRESSED SIZE: 1440000
X RESOLUTION: 11811
Y RESOLUTION: 11811
USED COLORS: 0
IMPORTANT COLORS: 0
```