(60-140) ASSIGNMENT 5

Due: 11:59pm, Dec. 1, 2017

1. **9.5** (p. 214) Write a function `num_digits(n)` that returns the number of digits in `n` (a positive integer). Save the file to `a5_digits_fun.c`, and submit it online.

   Hint: To determine the number of digits in a number `n`, divide it by 10 repeatedly. When `n` reaches 0, the number of divisions indicates how many digits `n` originally had.

2. **9.6*** (p. 217) Use the RAPTOR program to design an algorithm with flowchart that computes the value using the polynomial formula $3x^5+2x^4-5x^3-x^2+7x-6$. The flowchart asks the user to enter a value for x, calls a function to compute the value of the polynomial, and then displays the value after the main flowchart receives the value of the polynomial. Save the flowchart in `a5_polynomial.rap`, and submit this file as your solution to this question.

3. **9.6** (p. 217) Produce a C program to implement the `a5_polynomial.rap` algorithm, with a requirement that the function must have a return type via which the value of the polynomial is returned by the function. Save the program in `a5_polynomial.c`, and submit this file online.

4. **10.2** (p. 238) The program on the right outlines only function definitions and variable declarations. For each of the following scopes, list in the box of online submission of Blackboard all variable and parameter names visible in that scope. If there's more than one variable or parameter with the same name, indicate which one is visible.

   (a) The `f(.)` function

   (b) The `g(.)` function

   (c) The block in which `a` and `d` are declared

   (d) The `main(.)` function

```
int b, c;
void f(void) {
  int b, d;
}
void g(int a) {
  int c;
  {
    int a, d;
  }
}
void main(void) {
  int c, d;
}
```

5. **22.12*** (p. 587) Shown on the next page is the unfinished design of an algorithm that modifies A1.Q6 to allow simulated user inputs being saved in a file by calling the `PrepareDate` procedure/function from the main flowchart. The remaining two procedures/functions are supposed to read in the data (`ObtainData`) and print the output (`PrintData`) in a format as specified in A1.Q6.

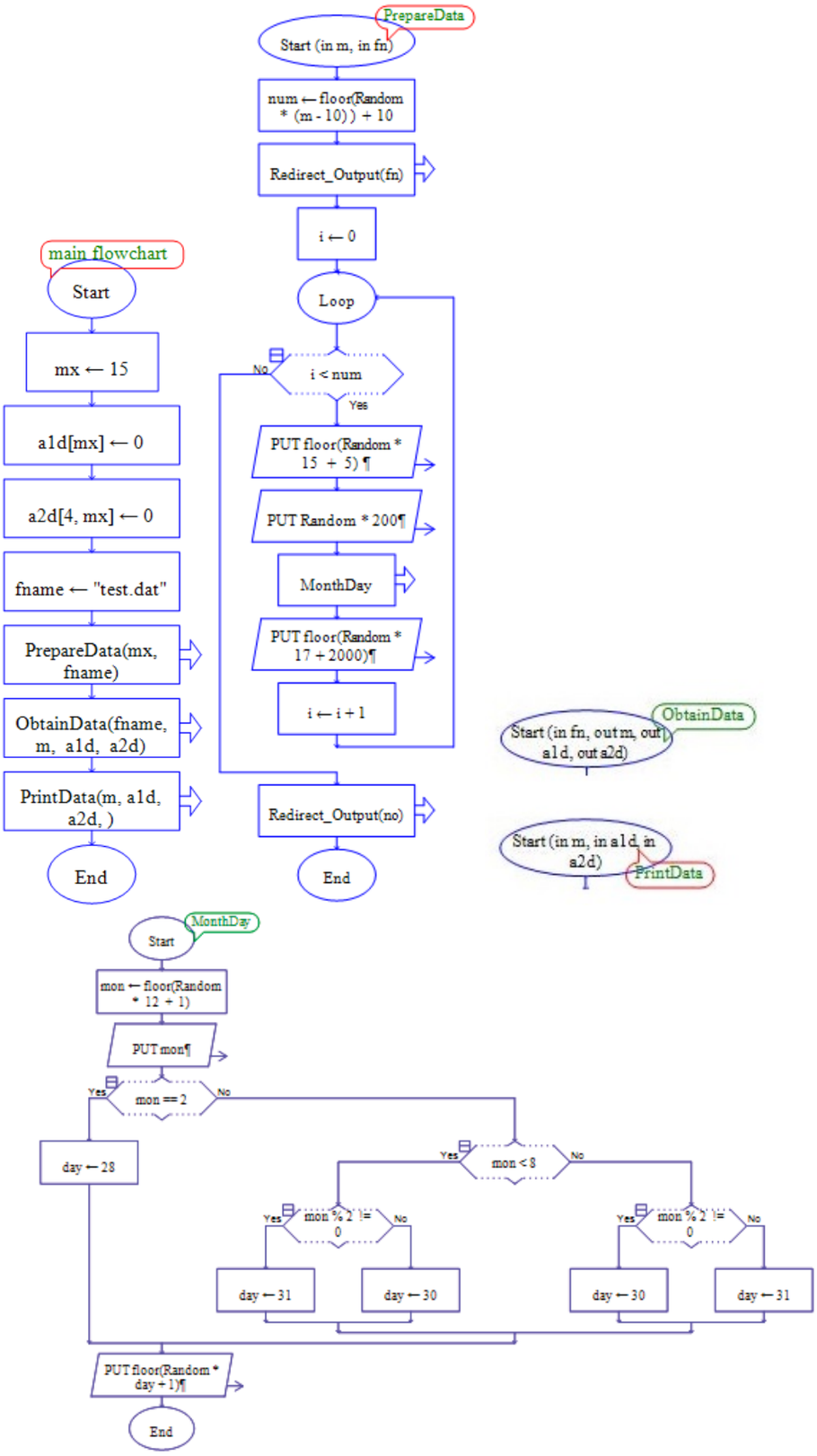
   (a) Given the lists of parameters of `ObtainData` and `PrintData` in the figure (next page), finish the algorithm design. Save the flowchart in `a5_file_access.rap`, and submit this file as your solution to this question.

   (b) (optional with bonus marks) Make the printed list of products sorted by item numbers.

6. **22.12** (p. 587) Produce a C program to implement the `a5_file_access.rap` algorithm, whose output needs to be formatted as in the screenshot. Save the file in `a5_file_access.c`, and submit online.

```
Item            Unit            Purchase
                Price           Date
12              $ 28.93         11/03/2011
 7              $172.67         10/15/2001
15              $188.99         10/13/2000
17              $ 77.15         10/05/2008
 9              $162.63         08/17/2003
```

Note: The full bonus marks will be awarded if algorithm design with flowchart and implementation in C are both functional and correct, which means that product items in the screenshot should be sorted by item numbers as well.


main flowchart
Start
mx ← 15
a1d[mx] ← 0
a2d[4, mx] ← 0
fname ← "test.dat"
PrepareData(mx, fname)
ObtainData(fname, m, a1d, a2d)
PrintData(m, a1d, a2d,)
End
PrepareData
Start (in m, in fn)
num ← floor(Random * (m - 10)) + 10
Redirect_Output(fn)
i ← 0
Loop
No
i < num
Yes
PUT floor(Random * 15 + 5) ¶
PUT Random * 200¶
MonthDay
PUT floor(Random * 17 + 2000)¶
i ← i + 1
Redirect_Output(no)
End
ObtainData
Start (in fn, out m, out a1d, out a2d)
Start (in m, in a1d, in a2d)
PrintData
MonthDay
Start
mon ← floor(Random * 12 + 1)
PUT mon¶
Yes
mon == 2
No
day ← 28
Yes
mon < 8
No
Yes
mon % 2 != 0
No
day ← 31
day ← 30
Yes
mon % 2 != 0
No
day ← 30
day ← 31
PUT floor(Random * day + 1)¶
End