CS/MATH111 ASSIGNMENT 4

Problem 1: Give the asymptotic value (using the Θ-notation) for the number of letters that will be printed by the algorithms below. In each algorithm the argument n is a positive integer. Your solution needs to consist of an appropriate recurrence equation and its solution. You also need to give a brief justification for the recurrence.

Part (a)

(i) **Algorithm** PRINTAS (n : **integer**)
```
if n < 4
    print("A")
else
    PRINTAS(⌈n/3⌉)
    PRINTAS(⌈n/3⌉)
    PRINTAS(⌈n/3⌉)
    PRINTAS(⌈n/3⌉)
    PRINTAS(⌈n/3⌉)
    for i ← 1 to 4n^2 do print("A")
```

(ii) **Algorithm** PRINTBS (n : **integer**)
```
if n < 2
    print("B")
else
    for j ← 1 to 8 do PRINTBS(⌊n/2⌋)
    for i ← 1 to 10n^3 do print("B")
```

(iii) **Algorithm** PRINTCS (n : **integer**)
```
if n < 3
    print("C")
else
    PRINTCS(⌈n/2⌉)
    PRINTCS(⌈n/2⌉)
    PRINTCS(⌈n/2⌉)
    PRINTCS(⌈n/2⌉)
    for i ← 1 to 20 do print("C")
```

Part (b)

(iv) **Algorithm** PRINTDS (n : **integer**)
```
if n < 2
    print("D")
else
    for j ← 1 to 4 do PRINTDS(⌊n/2⌋)
    for i ← 1 to 10n^k do print("D"),
```

where k is a nonnegative integer.

Problem 2: Bill is buying his wife a bouquet of carnations, roses, tulips, daises, and lilies. The bouquet will have 28 flowers, with

- at most 6 carnations,
- between 3 and 7 roses,
- between 2 and 11 tulips,
- at least 4 daises, and
- at least 1 lily.

How many different combinations of flowers satisfy these requirements? You need to use the counting method for integer partitions and show your work.

Problem 3: We have three sets P, Q, R with the following properties:

(a) $|P| = 3|Q|$ and $|R| = |P|$,

(b) $|P \cap Q| = 11$, $|Q \cap R| = 14$, $|P \cap R| = 2|Q|$,

(c) $7 \leq |P \cap Q \cap R| \leq 17$,

(d) $|P \cup Q \cup R| = 100$.

Use the inclusion-exclusion principle to determine the number of elements in P. Show your work. (Hint: You may get an equation with two unknowns, but one of them has only a few possible values.)

Submission. To submit the homework, you need to upload the pdf file into ilearn and Gradescope.