DEPARTMENT OF MATHEMATICS

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Tutorial Group: B, Mon 14:00, E8A 188

Tutor: Mitch Buckley

Due 14:00 17/05 2013

DMTH237 S113

Discrete Mathematics II

Assignment 4

Please sign the declaration below, and staple this sheet to the front of your solutions. Your assignment must be submitted at the Science Centre, E7A Level 1.

Your assignment must be STAPLED, please do not put it in a plastic sleeve.

PLAGIARISM Plagiarism involves using the work of another person and presenting it as one's own. For this assignment, the following acts constitute plagiarism:

a) Copying or summarizing another person's work.

b) Where there was collaborative preparatory work, submitting substantially the same final version of any material as another student.

Encouraging or assisting another person to commit plagiarism is a form of improper collusion and may attract the same penalties.

STATEMENT TO BE SIGNED BY STUDENT

1. I have read the definition of plagiarism that appears above.
2. In my assignment I have carefully acknowledged the source of any material which is not my own work.
3. I am aware that the penalties for plagiarism can be very severe.
4. If I have discussed the assignment with another student, I have written the solutions independently.

SIGNATURE..

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1. Find the coefficient of X^{10} in the function: $F(X) = (1-2X)^{-7} + (1+3X)^{-4}$.

2. How many ways are there to distribute 15 objects among five distinct assembly lines when the first two lines must get at least two objects, the third and the fifth line should get a non-zero but even number of objects, and the fourth line gets any number of objects?

3. Find the general solution of $a_{n+2} + 10\,a_{n+1} + 25\,a_n = 0$.

4. Find the general solution of the homogeneous recurrence whose characteristic equation is

$$(\lambda+3)^2\,(\lambda-4)^3\,(\lambda+5)^4 = 0\,.$$

5. Design a Turing Machine to construct the function $f(n) = 3\,\lfloor \frac{1}{3}n \rfloor + 2$, (that is, 2 more than $3\times$ the integer part of $\frac{1}{3}n$) for $n \in \mathbb{N}$. Do not just produce a TM, but also describe briefly how it works.

   There is a TM in the Cooper notes that does almost this. Modify it to produce the required TM.

(assignment continued on next page)

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6. Prove by induction on n that if the following Turing Machine is started with a blank tape, after $10\,n+3$ steps the machine will be in state [4] with the tape reading $\ldots 0(1110)^n 1\underset{\uparrow}{1}10\ldots$

	0	1
0	$1R1$	$0L5$
1	$1R2$	$1R5$
2	$1L4$	$1L5$
3	$0R0$	$1R3$
4	$0R3$	$1L4$