

MCS 256 Discrete Calculus and Probability Set 3

Homework rules

- Acknowledge your sources (people and texts).
- In nontrivial problems, show *how* you get your answers.
- Turn in neat, well-written solutions, not messy first drafts. Trim "fringes."
- Do not copy collaborative solutions; write up solutions in your own words.
- Do extra credit problems entirely on your own.
- Turn in homework on time. Each class day late reduces the possible points by 25%.

Problems

(1) Use synthetic division (show!) to divide $5x^4 - 6x^3 + 7x^2 + 8$ by $x + 2$, getting a quotient polynomial and a remainder.

(2) Express $2x^3 - 3x^2 + 5x - 4$ as a factorial polynomial, i.e., find coefficients A, B, C, D such that

$$2x^3 - 3x^2 + 5x - 4 = Ax^{\underline{3}} + Bx^{\underline{2}} + Cx^{\underline{1}} + D.$$

(3) Calculate the Stirling numbers of the second kind $\left\{ \begin{matrix} n \\ k \end{matrix} \right\}$ for $0 \leq k \leq n \leq 8$.

(4) Calculate the Stirling numbers of the first kind $\left[\begin{matrix} n \\ k \end{matrix} \right]$ for $0 \leq k \leq n \leq 8$.

(5) Compute the table of forward differences $\Delta^k g(x)$ for $k = 1, 2, 3$.

x	0	1	2	3	4	5	6	7	8
$g(x)$	829	407	161	43	5	-1	-23	-109	-307
$\Delta g(x)$									
$\Delta^2 g(x)$									
$\Delta^3 g(x)$									

What do you think are the most likely values for $g(9)$ and $g(10)$? Explain.

- (6) Complete this table with first, second, third, fourth, and fifth forward differences of $f(x) := g(2x)$

x	$g(x)$					
-8	829					
-6	407					
-4	161					
-2	43					
0	5					
2	-1					
4	-23					
6	-109					
8	-307					

- (7) Complete the table of divided differences for the function $g(x)$ in the previous problems. Determine the most likely values of $g(10)$ and $g(12)$

REFERENCES

- [1] Graham, Knuth, and Patashnik, *Concrete Mathematics: A Foundation for Computer Science* 2/e, Addison-Wesley, Boston, 1994.