

King Fahd University of Petroleum and Minerals

College of Computer Science and Engineering
Information and Computer Science Department

ICS 353-04: Design and Analysis of Algorithms
Spring 2006-2007

Quiz#3, Monday April 2, 2007.

Name:

ID#:

1. (12 points) Horner's Rule:

- (4 points) Write down the algorithm developed by Horner to evaluate polynomials at a given point x .
- (8 points) Use Horner's algorithm to evaluate the following polynomial at $x = -3$

$$p(x) = 11x^7 + 32x^6 + 3x^5 + 19x^4 + 3x^3 + 10x^2 - 89$$

Note: An answer without using the algorithm is worth zero points.

a.

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1.  $p \leftarrow a_n;$   
1. for  $i \leftarrow 1$  to  $n$  do  
2.  $p \leftarrow x * p + a_{n-i};$ 
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b.

$$\begin{aligned} p &\leftarrow 11; \\ p &\leftarrow (-3)(11) + 32 = -1 \\ p &\leftarrow (-3)(-1) + 3 = 6 \\ p &\leftarrow (-3)(6) + 19 = 1 \\ p &\leftarrow (-3)(1) + 3 = 0 \\ p &\leftarrow (-3)(0) + 10 = 10 \\ p &\leftarrow (-3)(10) + 0 = -30 \\ p &\leftarrow (-3)(-30) + -89 = 1 \\ \therefore p(-3) &= 1 \end{aligned}$$

2. (8 points) Find the solution of the following recurrence equation in $\Theta()$ notation:

$$f(n) = \begin{cases} 1 & n < 4 \\ 2f(n/4) + \sqrt{n} & n \geq 4 \end{cases}$$

$$a=2, b=4 \quad n^{\log_a b} = n^{\log_2 4} = n^{\frac{\log_2 2}{\log_2 4}} = n^{1/2}$$

$$g(n) = n^{1/2} = \Theta(n^{\log_2 4})$$

Using case 2 of the Master theorem:

$$f(n) = \Theta(n^{1/2} \log n)$$