CIS 3223 Short Quiz 2

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Name: Solutions

Temple ID (last 4 digits:

1   Answer the following (circle answer).

(a) The bit-length of F_n, the n-th Fibonacci number, is

$\theta(\log n)$ $\quad$ $\boxed{\theta(n)}$ $\quad\quad$ $\theta(n \log n)$ $\quad\quad$ $\theta(n^2)$ $\quad\quad$ $\theta(2^n)$

$F_n \sim \frac{1}{\sqrt{5}} \left(\frac{1+\sqrt{5}}{2} \right)^n \quad \log_2 F_n \sim n \log_2 \left(\frac{1+\sqrt{5}}{2} \right) = \theta(n)$

(b) The runtime for computing the product of two n-bit numbers using Karatsuba'a alogorithm is

$\theta(n)$ $\quad\quad$ $\theta(n \log n)$ $\quad\quad$ $\theta(n^{\sqrt{3}})$ $\quad\quad$ $\boxed{\theta(n^{\log_2 3})}$ $\quad\quad$ $\theta(n^2)$

$T(n) = 3 T\left(\left\lceil \frac{n}{2} \right\rceil \right) + \theta(n)$

(c) For integers $a, b, c,$ and d, if $a + bc + d = 0$, then $\quad$ $\boxed{\text{True}}$ $\quad$ False
$gcd(a, b) = gcd(b, d)$

$a = bq + r$

$c = -q, \quad d = -r$

(d) $\forall n \in \mathbb{Z}^+ \boxed{\exists s \in \mathbb{Z}} (n \le 3^s < 3n)$ $\quad\quad$ Either $\quad\quad$ True $\quad$ False

Give 1 point

$n = 1, \quad s = 0 \quad$ False

$n > 1, \quad s \in \mathbb{Z}^+ \quad$ True

Should have read $\exists s \in \mathbb{Z}$