✓ **Congratulations! You passed!**

TO PASS 80% or higher

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Problem Set #2

LATEST SUBMISSION GRADE

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1. This question will give you further practice with the Master Method. Suppose the running time of an algorithm is governed by the recurrence $T(n) = 7 * T(n/3) + n^2$. What's the overall asymptotic running time (i.e., the value of T(n))? **1 / 1 point**

- ○ $\theta(n \log n)$
- ○ $\theta(n^2 \log n)$
- ○ $\theta(n^{2.81})$
- ◉ $\theta(n^2)$

✓ **Correct**

a=7, b=3, d=2. Since b^d > a, this is case 2 of the Master Method.

2. This question will give you further practice with the Master Method. Suppose the running time of an algorithm is governed by the recurrence $T(n) = 9 * T(n/3) + n^2$. What's the overall asymptotic running time (i.e., the value of T(n))? **1 / 1 point**

- ○ $\theta(n \log n)$
- ○ $\theta(n^2)$
- ◉ $\theta(n^2 \log n)$
- ○ $\theta(n^{3.17})$

✓ **Correct**

a = b^d = 9, so this is case 1 of the Master Method.

3. This question will give you further practice with the Master Method. Suppose the running time of an algorithm is governed by the recurrence $T(n) = 5 * T(n/3) + 4n$. What's the overall asymptotic running time (i.e., the value of T(n))? 1 / 1 point

- ○ $\theta(n^2)$
- ○ $\theta(n^{5/3})$
- ◉ $\theta(n^{\log_3(5)})$
- ○ $\theta(n \log(n))$
- ○ $\theta(n^{2.59})$
- ○ $\theta(n^{\frac{\log 3}{\log 5}})$

✓ **Correct**
a = 5, b = 3, d = 1. Since a > b^d, this is case 3 of the Master Method.

4. Consider the following pseudocode for calculating a^b (where a and b are positive integers) 1 / 1 point

```
1  FastPower(a,b) :
2    if b = 1
3      return a
4    else
5      c := a*a
6      ans := FastPower(c,[b/2])
7    if b is odd
8      return a*ans
9    else return ans
10 end
```

Here [x] denotes the floor function, that is, the largest integer less than or equal to x.

Now assuming that you use a calculator that supports multiplication and division (i.e., you can do multiplications and divisions in constant time), what would be the overall asymptotic running time of the above algorithm (as a function of b)?

- ○ $\Theta(b)$
- ◉ $\Theta(\log(b))$
- ○ $\Theta(\sqrt{b})$
- ○ $\Theta(b \log(b))$

✓ **Correct**
Constant work per digit in the binary expansion of b.

5. Choose the smallest correct upper bound on the solution to the following recurrence: $T(1) = 1$ and $T(n) \leq T(\lceil \sqrt{n} \rceil) + 1$ for $n > 1$. Here [x] denotes the "floor" function, which rounds down to the nearest integer. (Note that the Master Method does not apply.) 1 / 1 point

- ○ $O(\sqrt{n})$
- ○ $O(1)$
- ○ $O(\log n)$
- ◉ $O(\log \log n)$

✓ **Correct**
Bingo! This answer may be easiest to see by writing n as $2^{\log n}$ and then noting that every square-root operation cuts the exponent in half.