Q1 Asymptotic Analysis: Visually
5 Points

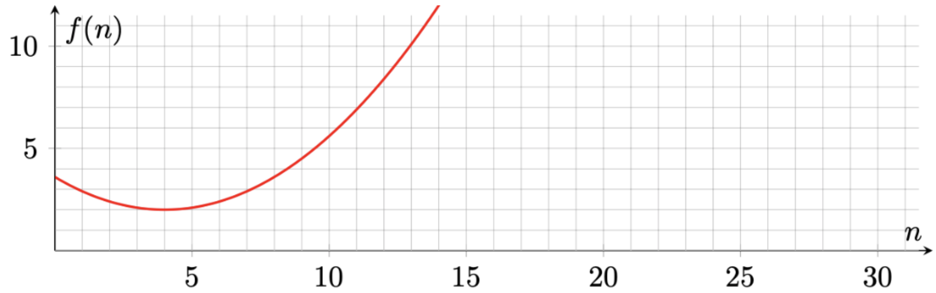
For each of the following plots, list **all** possible Ω, Θ, and $\mathcal{O}$ bounds from the following choices, **not just the tight bounds**:

$$1, \log(n), n, n^2$$

Assume that the plotted functions continue to follow the same trend shown in the plots as n increases. Each provided bound must either be a constant or a simple polynomial.

Q1.1 a
1 Point

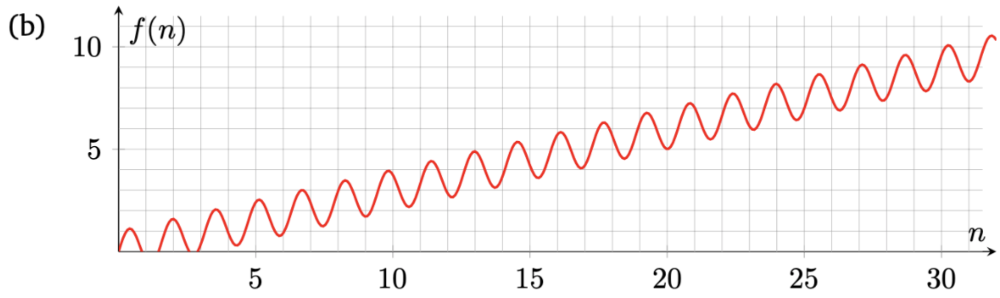
(a)



- [ ] $\mathcal{O}(n^2)$
- [ ] $\mathcal{O}(1)$
- [ ] $\mathcal{O}(n)$
- [ ] $\mathcal{O}(\log(n))$
- [ ] $\Omega(n^2)$
- [ ] $\Omega(1)$
- [ ] $\Omega(n)$
- [ ] $\Omega(\log(n))$
- [ ] $\Theta(n^2)$
- [ ] $\Theta(1)$
- [ ] $\Theta(n)$
- [ ] $\Theta(\log(n))$

Save Answer

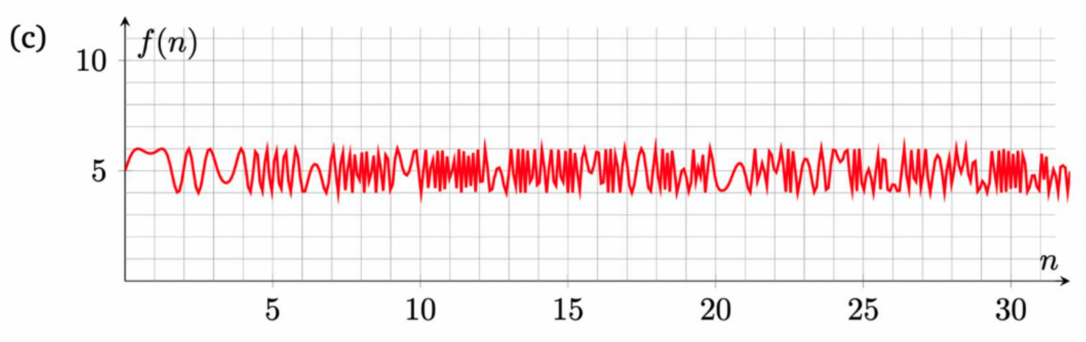
Q1.2 b
1 Point



- [ ] $\mathcal{O}(n^2)$
- [ ] $\mathcal{O}(1)$
- [ ] $\mathcal{O}(n)$
- [ ] $\mathcal{O}(\log(n))$
- [ ] $\Omega(n^2)$
- [ ] $\Omega(1)$
- [ ] $\Omega(n)$
- [ ] $\Omega(\log(n))$
- [ ] $\Theta(n^2)$
- [ ] $\Theta(1)$
- [ ] $\Theta(n)$
- [ ] $\Theta(\log(n))$

Save Answer

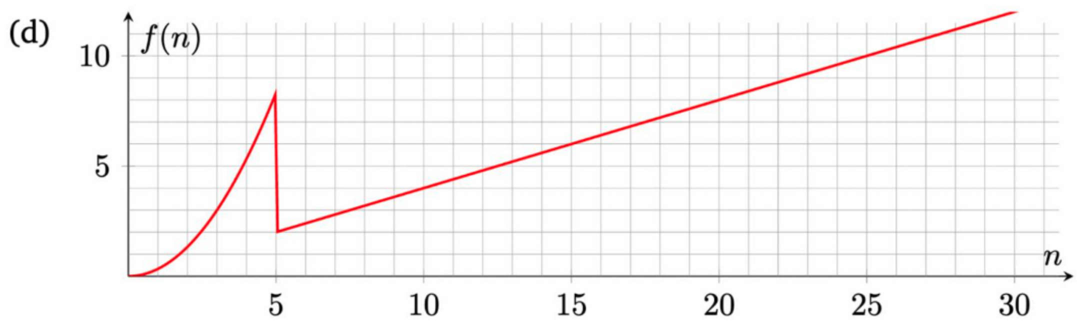
Q1.3 c
1 Point



- [ ] $\mathcal{O}(n^2)$
- [ ] $\mathcal{O}(1)$
- [ ] $\mathcal{O}(n)$
- [ ] $\mathcal{O}(\log(n))$
- [ ] $\Omega(n^2)$
- [ ] $\Omega(1)$
- [ ] $\Omega(n)$
- [ ] $\Omega(\log(n))$
- [ ] $\Theta(n^2)$
- [ ] $\Theta(1)$
- [ ] $\Theta(n)$
- [ ] $\Theta(\log(n))$

Save Answer

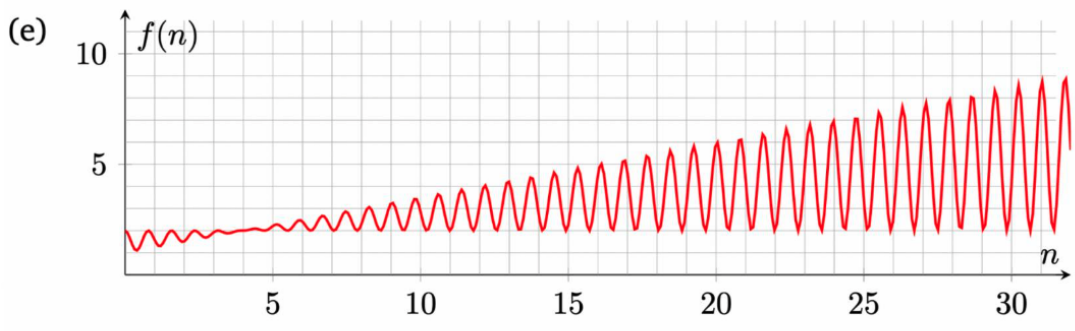
Q1.4 d
1 Point



- [ ] $\mathcal{O}(n^2)$
- [ ] $\mathcal{O}(1)$
- [ ] $\mathcal{O}(n)$
- [ ] $\mathcal{O}(\log(n))$
- [ ] $\Omega(n^2)$
- [ ] $\Omega(1)$
- [ ] $\Omega(n)$
- [ ] $\Omega(\log(n))$
- [ ] $\Theta(n^2)$
- [ ] $\Theta(1)$
- [ ] $\Theta(n)$
- [ ] $\Theta(\log(n))$

Save Answer

Q1.5 e
1 Point



- [ ] $\mathcal{O}(n^2)$
- [ ] $\mathcal{O}(1)$
- [ ] $\mathcal{O}(n)$
- [ ] $\mathcal{O}(\log(n))$
- [ ] $\Omega(n^2)$
- [ ] $\Omega(1)$
- [ ] $\Omega(n)$
- [ ] $\Omega(\log(n))$
- [ ] $\Theta(n^2)$
- [ ] $\Theta(1)$
- [ ] $\Theta(n)$
- [ ] $\Theta(\log(n))$

Save Answer

Q2 Asymptotic Analysis: Conceptual

3 Points

For each statement, identify if it is True or False.

Q2.1

1 Point

If a function is in $\Theta(logN)$, then it could also be $\mathcal{O}(N)$.

True

False

Save Answer

Q2.2

1 Point

If a function is in $\Omega(N^2)$, then it could also be $\mathcal{O}(N^2logN)$.

True

False

Save Answer

Q2.3

1 Point

If a function is $\Omega(N^2)$, then it is **never** in $\mathcal{O}(N^2)$.

True

False

Save Answer

Q3 Asymptotic and Case Analysis: Through Code

2 Points

Congratulations! You got the job offer at Hash Tea. Today marks your first day on the job and your employers help catch you up to speed by giving you a function to complete n boba orders. Analyze the code snippet below and answer the following questions.

Note: the method call to `blend()` is known to take time $\Theta(log k)$, where k is the size of `blend()`'s input. The method `blend()` outputs `true` or `false` depending on if blending the `sugar` and `milkTea` made the delicious foam correctly.

```
boolean makeBobaOrder(int n) {
    int sugar = 2 * n;
    int milkTea = n;
    if (n <= 0) {
        return false;
    }
    for (int i = 0; i < n; i++) {
        for (int j = 0; j < 8; j++) {
            if (!blend(sugar * milkTea)) {
                return false;
            }
        }
    }
    return true;
}
```

Q3.1

2 Points

Under what conditions will the `makeBobaOrder()` function be a constant time operation?

$n < 0$

$n \leq 0$

$n \leq 1$

$n = 1$

Save Answer

Q4 Case Analysis Discussion

5 Points

Consider the following method.

```
static int help(int N) {
    if (N < 1000) {
        for (int i = 0; i < N * N * N; i += 1) {
            System.out.print("be");
        }
        return N;
    } else {
        for (int i = 0; i < N / 2; i += 1) {
            System.out.print("be");
        }
        return 2 * help(N / 2);
    }
}
```

Q4.1 Defining N

5 Points

True or False. The best-case asymptotic runtime analysis for `help` is when N is less than 1000.

Explain your reasoning in 2-3 sentences.

Hint: Look back at the definition of asymptotic analysis we discussed during lecture, especially with how N is defined and involved with asymptotic analysis and case analysis.

Save Answer

Save All Answers

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