Week 1 Quiz

The due date for submitting this assignment has passed. **Due on 2019-09-11, 23:59 IST.**

Assignment submitted on 2019-09-10, 10:20 IST

All questions carry equal weightage. You may submit as many times as you like within the deadline. Your final submission will be graded.

1) What does `f(250,2)` return??

```
f(m,n) {
  ans = 1;
  count = 0;
  while (ans <= m) {
    count = count + 1;
    ans = ans * n;
  }
  return(count)
}
```

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Yes, the answer is correct.
Score: 2

Accepted Answers:
*(Type: Regex Match) [ ]*8[ ]**

2 points

2) Suppose someone designs a new airline routing algorithm called MagicPath and claims that its worst-case complexity is $O(n^2 \log n)$. Which of the following statements is inconsistent with this claim. ***2 points***

- For every n, for every input of size n, MagicPath is able to solve the problem in time proportional to n^2.
- For some n, for every input of size n, MagicPath is able to solve the problem in time proportional to n^2.
- For every sufficiently large n, there is an input of size n for which MagicPath requires time proportional to n^2.
- For every sufficiently large n, there is an input of size n for which MagicPath requires time proportional to n^3.

Yes, the answer is correct.
Score: 2

Feedback:
$O(n^2 \log n)$ is an upper bound on worst-case complexity. It does not force any input to actually take that much time to solve. So the only contradiction is the statement that there are infinitely many n for which there are inputs of size n that take time $O(n^3)$.

Accepted Answers:
For every sufficiently large n, there is an input of size n for which MagicPath requires time proportional to n^3.

3) You are executing an algorithm with worst-case time complexity $O(n^4)$ on a CPU that can perform 10^8 operations per second. What is the most accurate guarantee for the time required to solve a worst case input of size 750? ***2 points***

- Under 3 minutes
- Under 3 hours
- Under 3 days
- Under 3 weeks

No, the answer is incorrect.
Score: 0

Feedback:
$750^4 = 3164 \times 10^8$. 3164 seconds is about 53 hours or just over 2 days.

Accepted Answers:
Under 3 days

4) Suppose f(n) is n^2 log n. Consider the following statements. **2 points**

- (A) f(n) is O(n $\sqrt{}$ n)
- (B) f(n) is O(n^2 $\sqrt{}$n)
- (C) f(n) is O(n^3)

Which of the following is true?

- (A), (B) and (C) are all not true.
- (B) and (C) are true but (A) is not true.
- (B) is true but (A) and (C) are not true.
- (A) and (B) are true but (C) is not true.

Yes, the answer is correct.
Score: 2

Feedback:
n $\sqrt{}$ n is not O(n^2 log n) so (A) is false. Both (B) and (C) are true.

Accepted Answers:
(B) and (C) are true but (A) is not true.

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5) In the code fragment below, `first` and `last` are integer values and `composite(x)` is a function that returns true if `x` is not a prime number and false otherwise. **2 points**

```
i = 0; j = 0; k = 0;
for (m = last; m >= first; m = m - 1){
  k = k + m;
  if (composite(m)){
    i = i + m;
  }else{
    j = j - m;
  }
}

if (…) {
  print("True");
}else{
  print("False");
}
```

Which of the following expressions can we put in place of the missing if condition (…) to ensure that the program prints "True"?

- `k == i + j`
- `k == i - j`
- `k == j - i`
- None of the other options is universally true. The expression depends on the values of `first` and `last`.

Yes, the answer is correct.
Score: 2

Feedback:
In every iteration, the increase in k is matched by an increase in i or a decrease in j. Hence, k = i - j is an invariant. If m is composite, this changes to (k+m) = (i+m) - j. If m is not composite, this changes to (k+m) = i - (j - m).

Accepted Answers:
`k == i - j`