CS 173 Errata

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This is a collection of various errors found in course material for CS 173. *Make sure you have the most up to date version by checking the Last Edited date at the top*. If you find more, please submit to this form. If you submitted an error and it is not here, then either I have not gotten to it or it was not actually an error. If no credit is given, the student wished to remain anonymous. Thank you to everyone who has found errors.

Lecture Videos

For each video, the corresponding part of the lecture notes has been fixed.

Functions

[Functions 3, 8:50]: Change **since g is onto** to **since g is one-to-one**. *Found by Jiya Chachan (chachan2)*

Graphs

[Graphs 2, 3:05]: Change **two choices for A/B** to **two choices for A/E**. *Found by Jiya Chachan (chachan2)*

Collections of Sets

[COS 3, 13:00]: Change all three $\{5, 10\}$ to $\{2, 5, 10\}$. *Found by jgand3*

Countability

[Countability 2, 4:00]: An element of $A_0 \times \cdots \times A_k$ is a $(k+1)$-tuple, not a k-tuple. *Found by rfaistl2*

Textbook

Chapter 4: Number Theory

[Page 40]: In the examples of the divides relation, the second to last bullet point should read $(-3) \mid 12$ because $12 = (-3) \cdot 4$.

[Page 43]: At the end of first paragraph change $\mathbf{gcd(140, 6500)}$ to $\mathbf{gcd(140, 650)}$

Chapter 5: Sets

[Page 56]: There is a minor typo in the second paragraph, change **wierd** to **weird**. *Found by ariette2*

Chapter 6: Relations

[Page 73]: The divides relation is not a partial order over $\mathbb{Z}$. In particular, it is not antisymmetric since $-3 \mid 3$ and $3 \mid -3$ but $3 \neq -3$. It is however a partial order over $\mathbb{N}$. *Found by Malcolm Kaplan (mkaplan6) & Arpit Bansal (arpitb2)*

Chapter 7: Functions and onto

[Page 84]: In the **positive** integers ($\mathbb{Z}^+$), only 1 has a multiplicative inverse; in the integers there's also -1.

Chapter 8: Functions and one-to-one

[Page 93]: In the proof of Claim 32, change $\mathbf{17_k}$ to $\mathbf{17^k}$.

Chapter 10: 2-Way Bounding

[Page 121]: In the proof of $A \subseteq \{\text{multiples of } 3\}$, change **4s + 3t** to **5s + 3t**. *Found by Fatih Atlamaz (atlamaz2)*

Chapter 13: Trees

[Page 150]: The proof of **Claim 46** seems to prove the wrong thing. A correct proof is given here:

Theorem 1 (Claim 46): A full m-ary tree with i internal nodes has $mi + 1$ nodes total.

Proof 1: Either a node is a child of another node, or it isn't. We first count the number of nodes who are children of other nodes. There are i internal nodes and since the tree is a full m-ary tree, every internal node must have exactly m children. Thus, there are mi nodes who are children of other nodes. Then there is exactly one node which isn't a child of another node: the root. This means the total number of nodes in the tree is $mi + 1$. □

As a corollary, we can compute the number of leaves. Either a node is an internal node or it is a leaf. The total number of nodes is $mi + 1$ by **Claim 46** and there are i internal nodes. Thus there are $mi + 1 - i = (m - 1)i + 1$ leaf nodes.

[Page 153]: The context-free grammar is missing a rule $E \rightarrow E + E$.

Chapter 14: Big-O

[Page 168]: In the definition of asymptotically similar, c must be non-zero.

[Page 173]: Change **Once n is large enough $\frac{2}{n+1}$ is at least $\frac{1}{2}$** to **Once n is large enough, $\frac{2}{n+1}$ is at most $\frac{1}{2}$**. *Found by Urja Khadilkar (uvk2)*

Chapter 15: Algorithms

[Page 180]: In the first sentence after the pseudocode at the top of the page, it should say we could have added n to the head of Q, not the tail since that is what is already written. *Found by Arpit Bansal (arpitb2)*

Chapter 20: Countability

[Page 229]: The textbook says "We can map this to a single real number by interleaving the digits of the two numbers...This defines a bijection between the two sets." While the overall idea is correct, technically there's some extra details one has to add to this argument to handle the fact that some reals can be represented in two ways (e.g. .399999... = .400000...).

If interested you can try fixing the argument yourself, and talk to us in OH to discuss further. *Found by Ben Cosman*

Study Problems

Trees

[Trees Problem 3 Solution]: In the inductive step change **Consider Q_k, where $1 \geq k$** to **Consider Q_k, where $k \geq 1$**. *Found by Arpit Bansal (arpitb2)*

Spring 2016

Examlet 10, Part B

[Page 5]: Each leaf contains the value **7**, not $\boldsymbol{d}$. Thus the sum is $\frac{d}{2}\sqrt{n}$. *Found by Fatih Atlamaz (atlamaz2)*

Spring 2017

Examlet 8, Part A

[Page 3]: At the end of the inductive step change $\mathbf{1-2^k+2\cdot 2^k}$ to $\mathbf{1-2^k+2\cdot 3^k}$. *Found by xinyuw13 & lingerg2*

Examlet 10, Part B

[Page 4]: The height should be changed from $\mathbf{\log_3 n - 3}$ to $\mathbf{\log_3 n - 2}$. *Found by Al-Waleed Al-Salti (alsalti2)*

Fall 2017

Examlet 12, Part B

[Page 1]: Change $\boldsymbol{f(m) = f(p) \cap f(q)}$ to $\boldsymbol{f(m) = f(a) \cap f(b)}$. *Found by Nathan Liu (nathan19)*

Spring 2018

Examlet 8, Part A

[Page 1]: Change all of the $\mathbf{\left(1+\frac{1}{x}\right)}$'s to $\boldsymbol{\left(x+\frac{1}{x}\right)}$. In particular the inductive step should be

$$x^{k+1} + \frac{1}{x^{k+1}} = \left(x^k + \frac{1}{x^k}\right)\left(x + \frac{1}{x}\right) - \left(x \cdot \frac{1}{x}\right)\left(x^{k-1} + \frac{1}{x^{k-1}}\right) = \left(x^k + \frac{1}{x^k}\right)\left(x + \frac{1}{x}\right) - \left(x^{k-1} + \frac{1}{x^{k-1}}\right).$$

Also change **We were also given that $\mathbf{\left(1+\frac{1}{x}\right)}$ is an integer** to **We were also given that $\boldsymbol{\left(x+\frac{1}{x}\right)}$ is an integer**. *Found by Fatih Atlamaz (atlamaz2)*

[Page 2]: The inductive step should read

$$\begin{aligned} h(k+1) &= 7h(k) + 12h(k-1) \\ &= 7(4^k - 3^k) - 12(4^{k-1} - 3^{k-1}) \\ &= 7(4^k - 3^k) - (3\cdot 4^k - 4\cdot 3^k) \\ &= (7-3)4^k - (7-4)3^k = 4^{k+1} - 3^{k+1}. \end{aligned}$$

Found by eryser2

Examlet 10, Part B

[Page 2]: The solution should read as follows. Consider $g(x) = x$ and $h(x) = x^2$. Then $\log(g(x)) = 2\log(h(x))$. So it can't be the case that $\log(g(x)) \ll \log(h(x))$. *Found by Sunwoo Baek (sunwoob2)*

[Page 4]: In end of the solution for Question 1, change $\boldsymbol{O \le f(x) \le ph(x)h(x)}$ to $\boldsymbol{0 \le f(x)g(x) \le ph(x)h(x)}$. *Found by Nathan Liu (nathan19)*

Spring 2019

Examlet 4, White

[Page 3]: Since the relation is defined over $\mathbb{N}^3$ and not $\mathbb{Z}^3$, $(-1,-2,-3)$ is not a valid answer. *Found by cren8*

Examlet 7, Colored

[Page 5]: In the chain of equalities in inductive step, change $\boldsymbol{\sum_{j=0}^{n}}$ to $\boldsymbol{\sum_{j=0}^{n} k}$. *Found by Kevin Ho (klho2)*

Examlet 7, White

[Page 6]: Since nodes h and k are adjacent to nodes e, they cannot be colored green and should be colored either red or blue. *Found by Chathurya Devineni (sd60)*

Examlet 8, Colored

[Page 2]: Change $\mathbf{3 \cdot 2^k(-1)^{k+1}}$ to $\mathbf{3 \cdot 2^k + (-1)^{k+1}}$ in both the last line in the inductive step as well as the last sentence. *Found by Al-Waleed Al-Salti (alsalti2)*

Examlet 8, White

[Page 2]: Change $\boldsymbol{F(n) = T(n/2^k) + \sum_{i=0}^{k-1} n \frac{1}{2^i}}$ to $\boldsymbol{F(n) = F(n/2^k) + \sum_{i=0}^{k-1} n \frac{1}{2^i}}$ *Found by Sunwoo Baek (sunwoob2)*

Examlet 10, Colored

[Page 4]: The beginning of the even case accidentally uses k instead of p in the body of the summation. Thus it should read

$$\sum_{p=1}^{k+1} \frac{(-1)^{p-1}}{p} = \frac{(-1)^k}{k+1} + \sum_{p=1}^{k} \frac{(-1)^{p-1}}{p}.$$

Found by Nathan Liu (nathan19)

Examlet 12, Colored

[Page 4]: Change **There are only two ways to factor 10 into two positive numbers** to **There are only two ways to factor 6 into two positive numbers**. *Found by Nathan Liu (nathan19)*

Spring 2020

Examlet 1, White

[Page 1]: In Question 1, the answer is correct but the intermediate work is wrong. In particular, Change $\boldsymbol{\log_2(a^b) = a\log_2(a)}$ to $\boldsymbol{\log_2(a^b) = b\log_2(a)}$. *Found by Kassidy He (kahe2)*

Examlet 2, Colored

[Page 3]: Change **Combining this with** $\boldsymbol{k(m-3) \leq k}$ to **Combining this with** $\boldsymbol{7(m-3) \leq k}$. Also at the end, change $\boldsymbol{k^2 - 9 = (m+3)(m-3)}$ to $\boldsymbol{m^2 - 9 = (m+3)(m-3)}$. *Found by Sunwoo Baek (sunwoob2) & Abdul Rafae Noor (arnoor2)*

[Page 5]: Change **Multiplying both sides by** $\boldsymbol{x(x+y)}$ to **Multiplying both sides by** $\boldsymbol{2(x+y)}$.

Examlet 2, White

[Page 1]: Change $\boldsymbol{p}$ **must divide** $\boldsymbol{a}$ **or** $\boldsymbol{c}$ to $\boldsymbol{p}$ **must divide** $\boldsymbol{b}$ **or** $\boldsymbol{c}$.

Examlet 3, Colored

[Page 6]: Change $\boldsymbol{4 \geq z^2 < x}$ to $\boldsymbol{4 \leq z^2 < x}$. *Found by Al-Waleed Al-Salti (alsalti2)*

Examlet 4, Colored

[Page 6]: In Case 4, change $\boldsymbol{x = y}$ to $\boldsymbol{q = y}$. *Found by Jason Min (jjmin2)*

Examlet 9, Colored

[Page 6]: In the inductive hypothesis, change $\boldsymbol{F_{h+1}}$ **leaves** to $\boldsymbol{F_{h+1}}$ **nodes**. *Found by Al-Waleed Al-Salti (alsalti2)*