**RGASC WDI Write-up: CSC236**

**[Writing samples were from problem sets completed towards the start and at the end of the term.]**

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 In general, the writing seen in CSC236 was in keeping with what would be expected from a second-year course, with certain unique issues occurring due to the highly technical nature of the writing. For example, many students structured their assignment as a series of disconnected statements, each on a separate line (see for example A3, A4, B17, B20, C14, D1), following the general format of a logical proof (e.g., “Let…”, “Then…”, “Thus…”). While this is undoubtedly an effective way of maintaining logical coherence within one’s writing (particularly important here given the nature of the assignment), submissions where these statements were explicitly incorporated into standard paragraphs (e.g., A1, A2) featured a greater variety of transition expressions, improving the continuity between statements and the overall quality of the submission. Beyond its effect on general readability, students’ attempts to write out their solution with the minimum possible text usually resulted in many confusing and/or poorly written sentences. For example, consider this statement by student B9: “If $n$ is even, by the Induction Hypothesis (the first move is to the “mid” rod), then the first step to move top $n$ disks to “mid” rod will be to the “end” rod, this is also the first step of moving $(n+1)$ disks, and $n+1$ is is odd, so $P(n+1)$ also is proven.”. Attempting to discuss this many interrelated aspects of their proposed solution all at once made the resulting sentence hard to follow.

*Word Choice*

 Issues related to word choice (alongside typos) were a common problem in many CSC236 submissions. While most word choice errors were trivial and had little impact on the intelligibility of the submission (e.g., writing “loose” instead of “lose”, “prove” instead of “proof”, “while” instead of “will”), there were occasionally cases where word choice errors resulted in substantial semantic ambiguity, altering the student’s proof/argument in such a way as to render it arguably incorrect. For example, A4 wrote: “To win the lifetime supply when the pile contains 24 cookies, it is better to go first. *The 1st player would start by eating the 3rd cookie*. No matter what choice the 2nd player makes, the 1st player will be able to eat the 8th cookie (since they can only choose to eat up to 4 cookies).” (italics added). Here, the student clearly means “start by eating 3 cookies”, but their phrasing changes their proof entirely. As currently written, they are implying the optimal strategy is to eat one cookie – namely, the third one. The phrasing here has implications beyond the student’s writing itself, as their next statement is false if the first player eats only one cookie. Given that the remainder of their proof follows correctly if we assume they meant “eat three cookies”, it is clear that this issue is entirely due to the student’s writing ability, rather than their underlying logic.

*Grammar*

 In keeping with other second-year courses that I have analyzed, the most common grammatical issue in CSC236 related to the proper use of plurals. To give a few examples: B6: “If the current player eat 2 cookies…”, C7: “…eating 4 cookie in their turn…”, B7: “This single nested loop apply to both…”, B15: “…there are string $a$, $b$, $c$ that satisfy”, B18: “However, this contradict the fact…”, C12: “First player eats 4 cookie, Second player eats 1 cookies.”. Most of these cases would have been caught by a standard spell-checking program, and it may be worth encouraging students to write their LaTeXcode in an editor with a built-in spell-check function. In addition to plurals, students often struggled with possessive forms (e.g., C10: “…should win if one’s can reduce the number…”, D3: “…on the next players turn…”). As with the issues related to plurals, standard spell-checking software would likely have caught these errors.

*Colloquial/Informal Language*

 The greatest improvement between the first and second submissions was in terms of the presence/absence of colloquial/informal language (Table 1). This is due to the fact that it was usually completely absent in the second submission, presumably due to TA or instructor feedback. Common issues included the use of exclamation marks (e.g., A6: “So, since $P(1)$, $P(2)$ hold, $P(n)$ must also hold true!”), informal statements (e.g., A9: “…if we take a look at the function…”), contractions (e.g., A10: “Let’s use prove by contradiction.”), slang (e.g., B17: “We can prove $P(n)$ directly, cause we can not make sure…”), and in one case, the use of emoticons (C13: “…as long as the person you are playing with doesn’t know the strategy ;)…”). Similarly, a marked reduction in the use of direct addresses to the reader (Impersonal Language in Table 1) was observed between PS1 and PS3. Almost all examples of a student directly addressing the reader were found in the first submission only (e.g., A5 PS1: “…you can reverse the moves you just made…”, B1 PS1: “It’s better to go first if you want to win…”, B19 PS1: “…you are in the most optimal position…”, C13 PS1: “…you should really go second…”).

*Incorporating Mathematical Symbols/Formulae*

 In general, students used mathematical symbols and formulae effectively to link their written material with their more formal arguments. However, attempts to incorporate mathematical formulae into written sections occasionally resulted in redundant statements. For example, in PS1, student D6 wrote: “Let $k\in Z^{+}$ be some positive integer.” Given that $k\in Z^{+}$ already translates to “$k$ is an element of the set of positive integers”, the inclusion of “…be some positive integer” is unnecessary (the full statement as written technically reads as “Let $k$ be an element of the set of positive integers be some positive integer.”). In general, cases like this would be improved if the student explicitly chose to use either set notation or a written description when describing an arbitrary element, but not both (i.e., write either “Let $k$ be some positive integer.” or “Let $k\in Z^{+}$.”).

*LaTeX Code*

 Virtually every submission in CSC236 contained a small number of errors in their underlying LaTeX code, which occasionally had a substantial effect on their writing. While most LaTeX errors were minor and had little to no impact on readability (e.g., backwards quotation marks [A3, A6, A7, A8, A9, A10, B13, B15, B17, B18, C2, C12, C18, C20, D2, D3], improper use of subscripts [“*min\_index*” vs. “*minindex*” – B8, B18, C12, D1, D8]), some submissions occasionally featured substantial errors that rendered much of their written material illegible. For example, in PS3, student D1 accidentally linked an equation and the written text following it in their underlying LaTeX code, such that the resulting sentence in the final document read:

“*…timesandtheminfunctioniscalled.Theminfunctionwascalledona…*”

In addition to the obvious spacing issues, this error caused much of the text to be printed off the page, rendering the second sentence unintelligible.

*Summary*

 Overall, there was limited improvement in the quality of student writing between PS1 and PS3, barring the substantial reduction in the amount of colloquial/overly personal language. Most students dramatically shortened the amount of written material included in their second submission, seemingly due to the structure of the third assignment making it more amenable to the use of point-form answers. Based on the values seen in Table 1, encouraging students to more carefully check the spelling and grammar of their submissions using standard spell-checking software would have the most immediate impact on the quality of writing seen in CSC236.

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| **Table 1:** Average scores (on a scale of 1 to 5) for the seven criteria assessed here, divided between two submissions: PS1 and PS3. Averages based on 60 students. |
|  | **Average** |
| **Sample** | **1 (PS1)** | **2 (PS3)** | **Difference** |
| **Complete Sentences** | 3.066667 | 3.144068 | 0.042373 |
| **Grammatical Correctness** | 2.908333 | 2.983051 | 0.067797 |
| **Sentence Intelligibility** | 3.225 | 3.245763 | 0.025424 |
| **Organization of Ideas** | 3.666667 | 3.728814 | 0.067797 |
| **Use of Transition Expressions** | 3.158333 | 3.220339 | 0.042373 |
| **Informal Language** | 3.791667 | 4.432203 | 0.661017 |
| **Impersonal Language** | 3.983333 | 4.525424 | 0.559322 |