Maximizing and minimizing problems existed before calculus.

Without using derivative find the exact minimum value of the function $\frac{(9x^2 \sin^2 x)+4}{x \sin x}$ for $0 < x < \frac{\pi}{2}$ and show that this minimum value is attainable in the given interval.

- Please **Submit** your solution to
  - *Dr. Tirtha Timsina,* ttimsina@gsu.edu or
  - *Dr. Christian Avart,* cavart@gsu.edu

  before the deadline: **Friday, March 1, 7:00PM**

  The WINNER will be awarded with a $15 gift certificate and will be announced in the NEXT issue.

Solution to the November Problem of the Month:

The problem as stated is not correct. What can be showed instead is slightly weaker (but more difficult to state) Here is what is true:

Imagine the bulbs are ordered: b_1,b_2... and so on and the switches also: s_1,s_2,...
There is a way to choose a position for s_1, then s_2, then s_3 and so on one after the other (and never change them after but possibly change the other switches), so that by doing so every interval of bulbs b_1,b_2...b_n (for every integer n) will eventually be all on.

To prove the statement above, consider an infinite sequence S_1,S_2... of states of the switches with the property that S_n turns on all switches s_1,s_2,...,s_n. This exists by assumption. Each of the switches states S_i defines a position for the first switch s_1. In particular, one (at least) position for s_1 must occur infinitely many times when considering all S_i. Chose such a position for s_1 (if both of them are possible make an arbitrary choice) and consider S'_1,S'_2... the subsequence of S_1,S_2... of the switches states with this chosen position for s_1. Similarly, we can chose a position for s_2 which occurs in infinitely many switches states S'_1,S'_2...Fix this position for s_2 and extract an infinite sequence S"_1,S"_2... of S'_1,S'_2... with the property that each switch states S"_i has s_2 in the chosen position. Repeating this process gives us what we need.
When we stated this problem, we assumed that repeating the process infinitely many times gives the answer to the original statement of last month problem. However, this is not the case as the following simple example shows. Consider a situation where the switch s_i controls the bulb b_i in the regular manner, i.e, turns it on and off with the exception that when all switches are "on" position, all the bulbs turn off. It is clear that in this situation, there is no way to turn all the bulbs simultaneously on.
This can be fixed by adding a "continuity" requirement on the way the switches operate the bulbs. If you are interested in learning more about it, please contact Dr. Avart.

Winner: No winner in January.