

For this assignment, you may (and are encouraged to) work in pairs; if you do so, only one member of the pair should submit a solution to the Curator and you must make sure that both students are identified (name and PID) in the submitted solution. You must also write your solutions in such a way that it is clear how each member contributed to deriving the solution.

Prepare your answers to the following questions in Word document or a plain ASCII text file; submissions in other formats will not be graded. Submit your file to the Curator system by the posted deadline for this assignment. No late submissions will be accepted. No other formats will be graded.

You will submit your answers to the Curator System ([www.cs.vt.edu/curator](http://www.cs.vt.edu/curator)) under the heading OOC01.

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For each question below, the quality of your explanation of how you derived the answer will carry more weight than whether you've stated a correct solution. If you applied one of the heuristics discussed in the course notes, identify the heuristic and explain how you applied it.

1. [25 points] In a cube with 1-foot sides, there are 2001 flies. Prove that at any moment, there must be a group of (at least) three that are all within a sphere of radius  $1/11$  feet.
2. [25 points] Show that no equilateral triangle can be completely covered by two smaller equilateral triangles.
3. [25 points] While searching for the Island of Lost Fedoras, Indiana Jones is shipwrecked and washed ashore on a small island in the Indian Ocean. Lying insensible on the shore of the island, Jones dreamed he was on an island inhabited by two tribes, one made up of people who always told the truth and one of people who always lie. He awoke to find two natives of the island standing over him.

"Where am I?" he asked. The first native replied "the Isle of Baloney". The second native objected "No! This is the Isle of Breadfruit".

Frustrated, Jones asked "who are you?". The first native said "I am Grim and he is Glum", pointing to the second native. The second native immediately said "I am Grim and HE is Glum".

A third native then walked up. Hoping for clarification, Jones asked the third native "which of them can I believe?". The third native pointed to the first native and said "he and I belong to the same tribe!". The second native then said "yes, they do belong to the same tribe".

Assuming Jones' dream was accurate, who was telling the truth and what was the name of the island?

4. [25 points] Shortly after Indiana Jones finished a raft on which he planned to leave the island, five natives arrived with food and water for his voyage. Jones asked each of them which tribe he belonged to.

"Three of us are Truthfuls" said the first native. The second native agreed, "yes, three of us are Truthfuls". "No, only two of us are Truthfuls" said the third native. Then the fourth native offered "the first three are all lying".

The fifth native then made a remark that left Jones with no doubts about which tribe each of the five natives belonged to. To which tribe did each of the five natives belong?