Question 1

Let \( \vec{f}(x, y, z) = (y^2z, y^3, xz) \), let \( V \subseteq \mathbb{R}^3 \) be given by \(-1 \leq x \leq 1, -1 \leq y \leq 1, 0 \leq z \leq 2\), and let \( S = \partial V \) be the boundary of \( V \). What is the value of the following surface integral? [Hint: use the divergence theorem.]

\[
\iint_S \vec{f} \cdot \vec{n} \, dS
\]

Answer 1.1: \( 2\pi \)
Answer 1.2: \( 8 \)
Answer 1.3: \( \infty \)

Question 2

How many inversions are there in the list below?

\[
\begin{array}{cccccccccccccccc}
3 & 2 & 1 & 6 & 6 & 10 & 5 & 11 & 8 & 8 & 15 & 9 & 13 & 14 & 16 \\
\end{array}
\]

Answer 2.1: \( 15 \)
Answer 2.2: \( 17 \)
Answer 2.3: \( 19 \)
Answer 2.4: \( 21 \)

Question 3

For which of the inputs below does the following circuit produce an output of 1?
Answer 3.1: \((x, y, z) = (1, 0, 1)\)

Answer 3.2: \((x, y, z) = (0, 0, 0)\)

Answer 3.3: \((x, y, z) = (0, 1, 0)\)

Answer 3.4: \((x, y, z) = (1, 0, 0)\)