Part I: (60 Points/10 Points each) Problems 1-7: Ascertain whether the infinite series converges or diverges. You must include the test, show how the condition(s) are met, run the test, and provide a conclusion. **Please complete 6 out of the 7 problems**. Be sure to write down your evil plan(s) or strategies; especially if you get stuck on a problem. **Cross out the problem that you do not want graded**.

1. $\sum_{n=1}^{\infty} \frac{(2n)!}{n^5}$

Step 1: Identify the test(s) and conditions (if applicable).

Step 2: Run the test.

Step 3: Conclusion.

2. $\sum_{n=4}^{\infty} \frac{(-1)^n n}{n-3}$

Step 1: Identify the test(s) and conditions (if applicable).

Step 2: Run the test.

Step 3: Conclusion.

3. $\sum_{n=1}^{\infty} \frac{n}{\sqrt{n^3 + 3n}}$

Step 1: Identify the test(s) and conditions (if applicable).

Step 2: Run the test.

Step 3: Conclusion.

4. $\sum_{n=1}^{\infty} \frac{\ln n}{n}$

Step 1: Identify the test(s) and conditions (if applicable).

Step 2: Run the test.

Step 3: Conclusion.

5. $\sum_{n=1}^{\infty}\left(\frac{4n}{7n-1}\right)^{n}$

Step 1: Identify the test(s) and conditions (if applicable).

Step 2: Run the test.

Step 3: Conclusion.

6. $\sum_{n=1}^{\infty}\left(\sqrt{e}\right)^{n}$

Step 1: Identify the test(s) and conditions (if applicable).

Step 2: Run the test.

Step 3: Conclusion.

7. $\sum_{n=1}^{\infty} \frac{2^n}{3^n - 1}$

Step 1: Identify the test(s) and conditions (if applicable).

Step 2: Run the test.

Step 3: Conclusion.

Part II: (30 points/10 points each) Problems 8-10. Complete the following problems.

8. Evaluate the definite integral and determine whether it converges or diverges.

$$\int_{-2}^{2} \frac{1}{x}\,dx$$

9. Find the sum of the convergent series.

$$\sum_{n=1}^{\infty}\left[\left(\frac{4}{5}\right)^{n}-\frac{1}{(n+1)(n+2)}\right]$$

10. Determine whether the series converges absolutely or conditionally, or diverges.

$$\sum_{n=1}^{\infty} \frac{\cos(n\pi)}{\sqrt{n}}$$

Part II: (10 points/2 points each) Problems 11-15. True or False.

11. T F If $\lim_{n\to\infty} a_n = 0$, $\sum_{n=1}^{\infty} a_n$ converges.

12. T F If $0 < a_n \le b_n$, and $\sum_{n=1}^{\infty} a_n$ converges, then $\sum_{n=1}^{\infty} b_n$ converges.

13. T F If $\{a_n\}$ is bounded and monotonic, $\{a_n\}$ converges.

14. T F The *n*th Term Test may be used to show convergence.

15. T F If $\sum_{n=1}^{\infty} a_n$ converges and has a sum of 3 and $\sum_{n=1}^{\infty} b_n$ converges and has a sum of 5, $\sum_{n=1}^{\infty} (a_n + b_n)$ will also converge and have a sum of 8.