

PROBLEM SET 15: ABSOLUTE CONVERGENCE; RATIO AND ROOT TESTS

Note: Most of the problems were taken from the textbook [1].

Problem 1. Use the Ratio Test to determine whether the series is convergent or divergent.

$$a) \sum_{n=1}^{\infty} \frac{1}{n!};$$

$$b) \sum_{n=1}^{\infty} \frac{n!}{100^n};$$

$$c) \sum_{n=1}^{\infty} \frac{\cos(n\pi/3)}{n!};$$

$$d) \sum_{n=1}^{\infty} \frac{n!}{n^n};$$

$$e) \sum_{n=1}^{\infty} \frac{(2n)!}{(n!)^2};$$

$$f) \sum_{n=1}^{\infty} \frac{2 \cdot 4 \cdot 6 \cdots (2n)}{n!};$$

Problem 2. Use the Root Test to determine whether the series is convergent or divergent.

$$a) \sum_{n=1}^{\infty} \left(\frac{n^2+1}{2n^2+1} \right)^n;$$

$$b) \sum_{n=2}^{\infty} \frac{(-1)^{n+1}}{(\ln n)^n};$$

$$c) \sum_{n=1}^{\infty} \left(\frac{-2n}{n+1} \right)^{5n};$$

$$d) \sum_{n=1}^{\infty} \left(1 + \frac{1}{n} \right)^{n^2};$$

$$e) \sum_{n=0}^{\infty} (\tan^{-1}(n))^n.$$

REFERENCES

- [1] J. Stewart: *Single Variable Calculus* 8th Edition, Cengage Learning, Boston 2015.