FALL 2019 PRACTICE TEST 2(1)

JAMES KEESLING

Problem 1. Determine the coefficients to estimate the derivative of $f(x)$ at $x = a$.

$$\left.\frac{df}{dx}\right|_{x=a} \approx A_0 \cdot f(a-4h) + A_1 \cdot f(a-h) + A_2 \cdot f(a) + A_3 \cdot f(a+h) + A_4 \cdot f(a+5h)$$

Problem 2. A medical test has the property that if it is administered to a person with the disease, the test is positive with probability .95. If the person does not have the disease, the probability of a false positive is .15. If the disease has a probability of $\frac{1}{500}$ and it is administered to a random person and the test is positive, what is the probability that the person has the disease?

Problem 3. What is the probability of 5 events in an interval of length 10 for a Poisson process with rate $\lambda = 3$?

Problem 4. What is the average number in the system for a queue of type M/M/1/FIFO where α is the arrival rate and σ is the service rate with $\alpha < \sigma$?

Problem 5. Solve the following differential equation using **Runge-Kutta**.

$$\frac{dx}{dt} = t^2 \cdot x$$

Solve over the interval $[0, 1]$ using $h = \frac{1}{10}$. Initial conditions are $x(0) = 1$.