GLOBAL FINAL EXAM

The use of computer is necessary. The solution of the problems has to be a unique file (pdf, word or something similar). The file has to include the solution, the codes used and the necessary explanations.

BLOCK 1

Let be a distribution of N points $x_j, j = 1, \cdots, N$. The function $f(x)$ is then defined as

$$f(x) = \sum_{i=1}^{N} \frac{1}{x - x_j} \tag{1}$$

1. Create a matlab function (.m file) that computes the value of $g(x)$

$$g(x) = \begin{cases} 100 & \text{if } f(x) > 100. \\ f(x) & \text{if } -100 \leq f(x) \leq 100. \\ -100 & \text{if } f(x) < -100. \end{cases} \tag{2}$$

   INPUTS: $x_j, j = 1 \cdots N; x$

   OUTPUT: $f(x)$

2. If N=5 and x_j are randomly located, with $0 \leq x_j \leq 10$, represent graphically $g(x)$ for $x \in [0, 10]$

3. If N=3, $x_1 = 0.$, $x_2 = 2$ and $x_3 = 10.$ obtain the position of a point in the interval $[0, 10]$ in which $g(x) \approx 0$

HELP 2: A list of m points (i.e. 1000) can be generated as vector x, then $y = g(x)$ and then function `plot(x,y)` can be used to generate the plot

HELP 3: The zero can be obtained by checking the minimum value of $|g(x_p)|, p = 1, m$ or using some alternative method as Newton-Raphson to obtain $g(x) = 0$