NOMBRE:CHRISTOFER FABIÁN CHÁVEZ CARAZAS CURSO MATEMÁTICA APLICADA A LA COMPUTACIÓN

1. Problema

Let z denote the vector whose entries are all ones (Using $MATLAB : z = ones(n, 1)$), and let $b = H_n z$, where H_n is again the nxn Hilbert matrix. If we now solve the system $H_n x = b$ for x, we should get z as the solution in theory. Using MATLAB, try solving $H_n x = b$ for $n = 4, 8, 12$, and 16, and see what you get. In each case compute the condition number $K_2(H_n)$ and the norm of the difference: $||\hat{x} - z||_2$, where x is the computed solution. Calculate the residual $\hat{r} = b - H_n\hat{x}, too.$

2. Resolución

- Comando utilizado para hallar las $\hat{x}$: **inv(hilb(n))*(hilb(n)*ones(n,1)**
- Comando utilizado para hallar el numbero de condición de las matrices de Hilbert: **cond(hilb(n),2)**

2.1. n = 4

$$\hat{x} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

$$K_2(H_4) = 15513{,}7387389292$$

$$||\hat{x} - z||_2 = Inf$$

$$\hat{r} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

2.2. n = 8

$$\hat{x} = \begin{bmatrix} 0{,}999999999781721 \\ 1{,}000000012107193 \\ 0{,}999999865889549 \\ 1{,}000000953674316 \\ 0{,}999997973442078 \\ 1{,}000003695487976 \\ 0{,}999997735023499 \\ 1{,}000000745058060 \end{bmatrix}$$

$$K_2(H_8) = 15257575538{,}0600$$

$$||\hat{x} - z||_2 = 1$$

$$\hat{r} = \begin{bmatrix} -1{,}79717677628588e-07 \\ -1{,}50963208822574e-07 \\ -1{,}30347141080733e-07 \\ -1{,}14779250770525e-07 \\ -1{,}02581775740518e-07 \\ -9{,}27550027896018e-08 \\ -8{,}46627511430498e-08 \\ -7{,}78795593570081e-08 \end{bmatrix}$$

2.3. n = 12

$$\hat{x} = \begin{bmatrix} 1{,}000002890825272 \\ 0{,}999629974365234 \\ 1{,}011596679687500 \\ 0{,}837890625000000 \\ 2{,}218750000000000 \\ -4{,}406250000000000 \\ 16{,}250000000000000 \\ -27{,}250000000000000 \\ 34{,}000000000000000 \\ -24{,}000000000000000 \\ 11{,}312500000000000 \\ -0{,}828125000000000 \end{bmatrix}$$

$$K_2(H_{12}) = 17514731907091464$$

$$||\hat{x} - z||_2 = 1$$

$$\hat{r} = \begin{bmatrix} 0{,}0949912272748490 \\ 0{,}0854571917313338 \\ 0{,}0776645584348064 \\ 0{,}0711762774616187 \\ 0{,}0656900195113981 \\ 0{,}0609901335181495 \\ 0{,}0569187092733036 \\ 0{,}0533574781002125 \\ 0{,}0502161103610116 \\ 0{,}0474244244605579 \\ 0{,}0449270644445785 \\ 0{,}0426797800631873 \end{bmatrix}$$

2.4. n = 16

$$\hat{x} = \begin{bmatrix} 0{,}999999046325684 \\ 1{,}000366210937500 \\ 0{,}992187500000000 \\ 1{,}062500000000000 \\ 0{,}000000000000000 \\ 4{,}000000000000000 \\ -32{,}000000000000000 \\ -16{,}000000000000000 \\ 24{,}000000000000000 \\ -8{,}000000000000000 \\ -16{,}000000000000000 \\ -10{,}500000000000000 \\ -48{,}000000000000000 \\ 96{,}000000000000000 \\ -16{,}000000000000000 \\ 12{,}000000000000000 \end{bmatrix}$$

$$K_2(H_{16}) = 786546777843164544$$

$$||\hat{x} - z||_2 = 1$$

$$\hat{r} = \begin{bmatrix} 4{,}80366486924009 \\ 4{,}14288737110991 \\ 3{,}63184575178155 \\ 3{,}22577690875621 \\ 2{,}89604221724863 \\ 2{,}62347113990895 \\ 2{,}39475549258432 \\ 2{,}20037540036119 \\ 2{,}03334702368229 \\ 1{,}88843548261652 \\ 1{,}76164311930311 \\ 1{,}64986698005578 \\ 1{,}55066371500547 \\ 1{,}46208460707313 \\ 1{,}38255752924964 \\ 1{,}31080099826630 \end{bmatrix}$$