Question 1

Consider the system in the figure with the following parameters

Component	MTBF	MTTR
Input transducer	100000 hours	2 hours
Output transducer	100000 hours	2 hours
Processor HW	10000 hours	2 hours
Processor SW	2190 hours	5 minutes
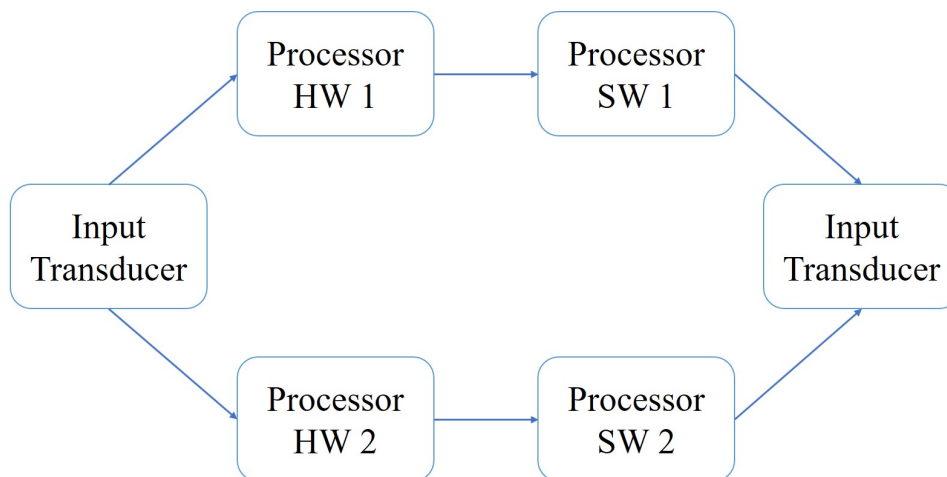
Assuming the system to be highly reliable (*i.e.* one set of processor hardware/software can carry the load), calculate the system unreliability in the following cases:
1) Component outages do not overlap at all.
2) Component outages have maximum overlap.

Question 2

Over the past period of time, a switch has been subjected to several maintenance periods of $2, 2.5, 1.5, 2.25$ hours, respectively. The corresponding operational periods of this switch are $1400, 1350, 1600$ and 1550 hours, respectively.
1) What is the unreliability of this switch?
2) What is your assessment of this switch's reliability as compared to what is usually expected?

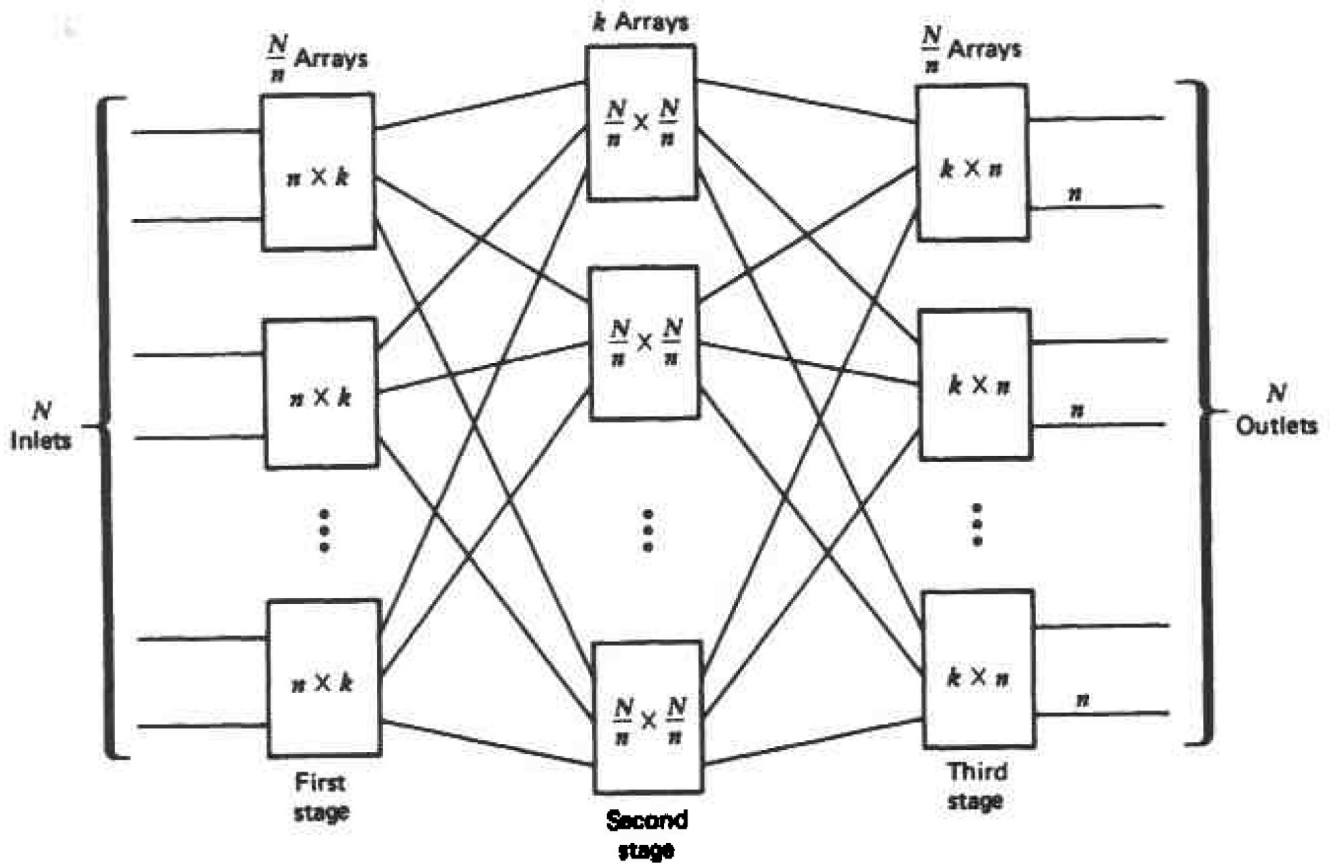## Question 3

Explain, using assisting graphs, the operation of the 2W $\leftrightarrow$ 4W hybrid.
When is it needed? What is the Balance Return Loss? And how is it calculated?

Question 4

Using the three-stage switch schematic below, find the condition that the switch is strictly non-blocking.

Give a recommended design for a three-stages switch that is strictly non-blocking, if the required switch capacity is 960 users. Justify that your recommended design achieves the least number of cross-points.

Question 5

Explain, briefly, each of the following transmission impairments:
1) Phase distortion
2) Crosstalk
3) Singing