

OPERATING SYSTEM – LABORATORY 5: SYNCHRONIZATION – THE BARBER SHOP

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The solution for the barber problems includes five semaphores. The first is semaphore barbers for woman, this semaphore has a value of $N1$ – number of barbers for woman. The second is semaphore barbers for man, this semaphore has a value of $N2$ – number of barbers for man. The third is semaphore barbers for both, this semaphore has a value of $N3$ – number of barbers for both. All of these three semaphores are used to tell whether the barber is idle or is working.

The barbers only cares about whether they have customer or not, so the semaphore *customer_available* was introduced for the barbers.

The last one is semaphore for free chairs, this semaphore has a value of M – number of chairs in waiting room, which means this semaphore has a maximum value of M , when a customer come in they wait for a free spot and once it's their turn to get a haircut, they free a chair and signal that there's now one chair free.

When the barber shop opens, the barber will execute the procedure barber, causing the barber to go to sleep and waits for the customer.

When the customer arrives, the customer will execute the procedure customer, causing the customer to check the chairs in the waiting room. If there are any free chairs, the customer sits on the chair in the waiting room, increase the semaphore *customers_available* to signal the barbers that there is a customer waiting. If this customer is a woman, and the available "barbers for woman" is greater than 0, the customer will wait for "barber for woman". Another case, if this customer is a man, and available "barbers for man" is greater than 0, the customer will wait for "barber for man". If the barbers for woman and the barbers for man are less than or equal 0, this customer will wait for "barber for both".

If there is no free chair in waiting room, the customer leave the shop.

When the customer and the barber are both awake, at this time, the barber is ready to give the customer a haircut. When the haircut is completed, check to see if the customer is a woman and the barbers for woman is less than $N1$, which means there is a barber for woman cutting hair for this woman, and then free this "barber for woman". Another case, if the customer is a man and the barbers for man is less than $N2$, which means there is a barber for man cutting hair for this man, and then free this "barber for man". If the barbers for woman equals $N1$ and the barbers for man equals $N2$, which means a customer is getting a haircut by a barber who does not belong to these two types of barber, and then free this "barber for both".

When it is over, the customer exits the procedure and if there is no more customer, the barbers will go back to sleep.

The flow chart:

