Exercise (in groups): vending machine 2.0

Use CCS to model a vending machine selling apples or chocolate bars

The system has 3 processes: a **user**, a **selector**, and a **dispenser**

- The **selector** accepts 2 types of coins from **user**: *coin10* (10 kr) and *coin20* (20 kr)
  - when the **selector** collects 10 kr., it lets the **user** select *apple*, or insert 10 kr. more
    - if the **user** selects *apple*, the **selector** tells the **dispenser** to *giveApple*
  - when the **selector** collects 20 kr., it lets the **user** select *choc*
    - if the **user** selects *choc*, the **selector** tells the **dispenser** to *giveChoc*
- The **dispenser** waits for the **selector** to tell either:
  - *giveApple* — in this case, the **dispenser** ouputs *takeApple*
  - *giveChoc* — in this case, the **dispenser** ouputs *takeChoc*
- The **user** may either:
  - insert 10 kr. in the **selector**, select *apple*, and then *takeApple* from the **dispenser**
  - insert 20 kr. in the **selector**, select *choc*, and then *takeChoc* from the **dispenser**

Optional tasks: can you hide *giveApple* and *giveChoc* from the **user**? Can you extend the system to **give change**, and then to sell a **bagel** for 30 kr.?

Exercise 2

Model the system below in CCS. **email your solution to** `hulo@dtu.dk` if you have questions.

The system has 3 processes: an **online shop**, a **warehouse**, and a **customer**

- The **shop** allows the **customer** to choose between two items: *jeans* or *shoes*
- When the **customer** asks to buy an item, the **shop** asks the **warehouse** whether the item is available, by sending *jeansAvailable* or *shoesAvailable*
- The **warehouse** may answer *yes* or *no*:
  - if the **warehouse** says *yes*, the **shop** says *available* to the **customer**, then asks for a *shippingAddress*
  - if the **warehouse** says *no*, the **shop** says *unavailable* to the **customer**

Use Pseuco's CCS Doctor tab to generate the inference tree for the case the **customer** receives the *unavailable* message

Optional: extend the system to support payments with an additional **bank** process:

- after *shippingAddress*, the **shop** also asks a *creditCardNumber* to the **customer**
- then, the **shop** requests a *payment* to the **bank**, which can answer either *accepted*

Exercise 3

Model the system below in Value-passing CCS. **email to** `hulo@dtu.dk` if you have questions.

IC is an insurance company which wants to offer a new insurance service for small objects ($\leq 2.000\text{Eur}$) managed completely online for reliable customers. To achieve this, a **customer** who wants his assets to be insured has to provide its *credentials* and the *cost* of the asset with its details (*serial number*, *purchase date*) to **IC**. To ensure that the customer is reliable and the asset inexpensive, IC will then check the customers credentials and past history and estimate the asset's price. If the checks *succeed*, a proposal will be sent back. Otherwise, the request will be *rejected*.