Computer Systems

Steven Moerman

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H6 De virtuele computer p6-1

- Principe zoals postkamer
  - Postbakjes (opslagruimte)
  - Persoon/verdeler (werker)
  - Postvak in (input)
  - Postvak uit (output)

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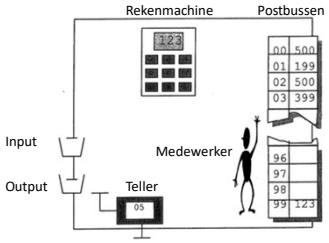

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H6 De virtuele computer

Getal	= instructie	+ adres
214	= 2	+14

- Instructie = Operation code of opcode

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H6 De virtuele computer

- Instructie = Operation code of opcode
  - Instructie 1 LOAD (bv. 117)
  - Instructie 2 STORE (bv. 234)
  - Instructie 3 ADD (bv. 347)
  - Instructie 4 SUBTRACT (bv. 453)
  - Instructie 5 INPUT (bv. 5xx)
  - Instructie 6 OUTPUT (bv. 6xx)
  - Instructie 7 HALT (bv. 7xx)

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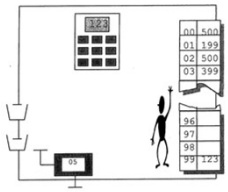
H6 De virtuele computer

- Instructie 1 LOAD (bv. 199)



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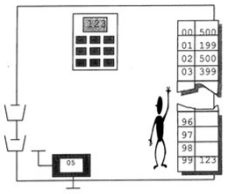
H6 De virtuele computer

- Oefening (oplossing)

00 103

Teller = 00
Load 03
REK = 399



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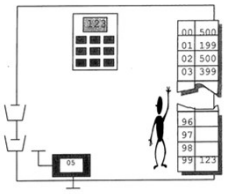
H6 De virtuele computer

- Oefening (oplossing)

00 101

Teller = 00
Load 01
REK = 199



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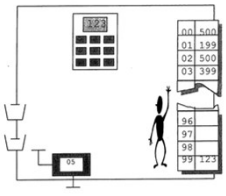
H6 De virtuele computer

- Instructie 2 STORE (bv. 234)



34 123

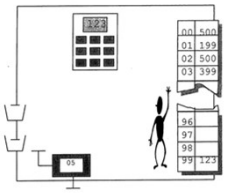
9

H6 De virtuele computer

- Oefening (oplossing)

00 101
01 298

T=00 REK=199
T=01 98=199



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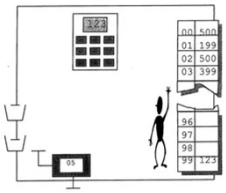
H6 De virtuele computer

- Oefening (oplossing)

00 102
01 201

T=00 REK=500
T=01 01=500



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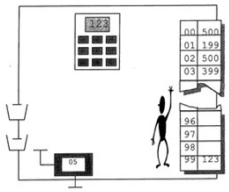
- Instructie 3 ADD (bv. 347)

REK+"47"
123+456
REK=579



47 456

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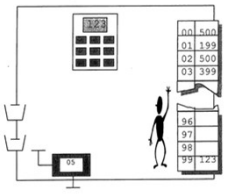
H6 De virtuele computer

- Oefening (oplossing)

00 102 REK=500
01 301 REK=699, 500+199



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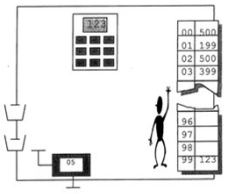
H6 De virtuele computer

- Oefening (oplossing)

00 103 REK=399
01 296 96=399
02 396 REK=798, 399+399
03 297 97=798



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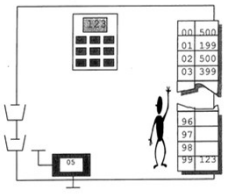
H6 De virtuele computer

- Oefening

00 199 LOAD 99, REK=123
01 298 STORE 98, 98=123
02 297 STORE 97, 97=123
03 296 STORE 96, 96=123
04 396 ADD 96, REK=246, 123+123
05 397 ADD 97, REK=369, 246+123



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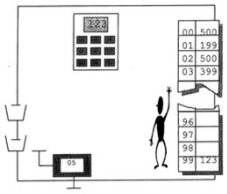
H6 De virtuele computer

- Instructie 4 SUBTRACT (bv. 499)



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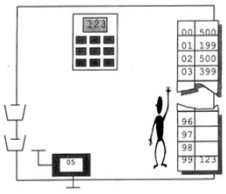
H6 De virtuele computer

- Oefening (oplossing)

00 101 LOAD 01, REK=199
01 499 SUBTRACT, REK=076, 199-123



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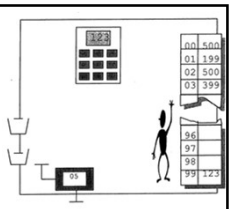
H6 De virtuele computer

- Oefening (oplossing)

00 103 LOAD 03, REK=399
01 298 STORE 98, 98=399
02 401 SUBTRACT 01, REK=399-199=200
03 302 ADD 02, REK=200+500=700
04 403 SUBTRACT 03, REK=700-399=301



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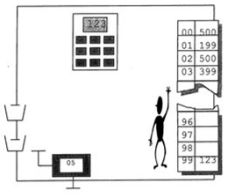
H6 De virtuele computer

- Instructie 5 INPUT (bv. 5xx)



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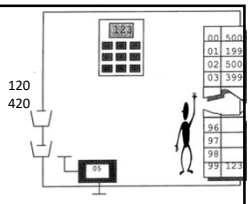
H6 De virtuele computer

- Oefening (oplossing)

00 199 LOAD 99, REK=123
01 501 INPUT, REK=120
02 520 INPUT, REK=420
03 298 STORE 98, 98=420
04 102 LOAD 02, REK=500
05 498 SUBTRACT 98, REK=500-420=080
06 296 STORE 96, 96=080



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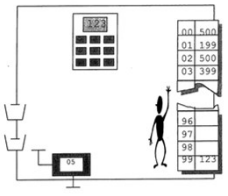
H6 De virtuele computer

- Instructie 6 OUTPUT (bv. 6xx)



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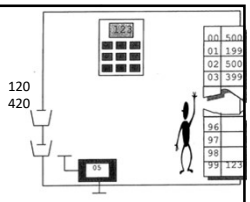
H6 De virtuele computer

- Oefening (oplossing)

00 199 LOAD 99, REK=123
01 501 INPUT, REK=120
02 298 STORE 98, 98=120
03 599 INPUT, REK=420
04 297 STORE 97, 97=420
05 498 SUBTRACT 98, REK=420-120=300
06 602 OUTPUT, OUTPUT=300



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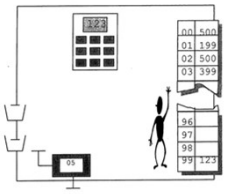
H6 De virtuele computer

- Instructie 7 HALT (bv. 7xx)



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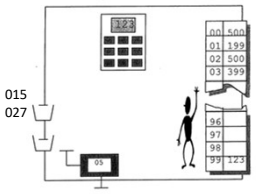
H6 De virtuele computer

- Oefening (oplossing)
  - 00 500 INPUT, REK=015
  - 01 299 STORE 99, 99=015
  - 02 502 INPUT, REK=027
  - 03 399 ADD 99, REK=027+ 015
  - 04 600 OUTPUT=042
  - 05 733 HALT



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H6 De virtuele computer

- Uitgebreide instructieset
  - Instructie 8 SKIP ON CONDITION
    - Adres 00 = SKIP eerstvolgende indien negatief
    - Adres 01 = SKIP eerstvolgende indien nul
    - Adres 02 = SKIP eerstvolgende indien positief of nul
  - Instructie 9 JUMP
    - Ga naar adres

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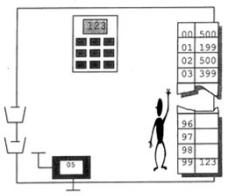
H6 De virtuele computer

- Instructie 8 SKIP ON CONDITION
  - 800
  - 801
  - 802



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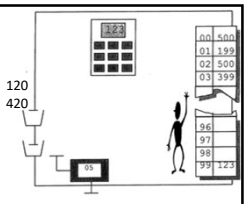
H6 De virtuele computer

- Oefening (oplossing)



00 199 LOAD 99, REK=123
01 302 ADD 02, REK=623
02 103 LOAD 03, REK=399
03 403 SUBTRACT 03, REK=399-399=0
04 801 SKIP next if 0
05 199 LOAD 99, REK=123 (niet uitgevoerd)
06 600 OUTPUT=0
07 700 HALT

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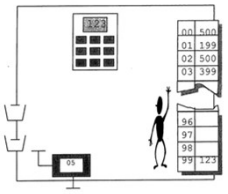
H6 De virtuele computer

- Instructie 9 JUMP (bv 903)
  - Teller op 03



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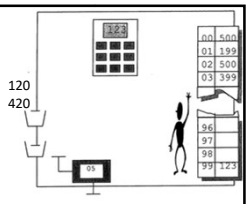
H6 De virtuele computer

- Oefening (oplossing)

```
00 199    LOAD 99, REK=123
01 599    INPUT, REK=120
02 910    JUMP 10
03 302
04 101
05 499
06 600
07 700

10 500    INPUT, REK=420
11 600    OUTPUT=420
12 700    HALT
```



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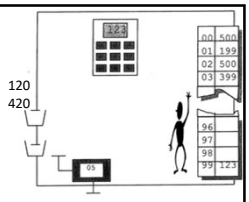
H6 De virtuele computer

- Oefening – omgekeerd (omgekeerd)

Geef op de output “200”.



00 103 LOAD 03, REK=399
01 401 SUBTRACT 01, REK=399-199=200
02 600 OUTPUT=200
03 700 HALT

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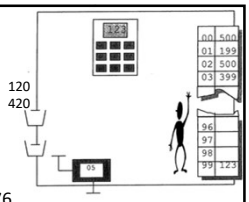
H6 De virtuele computer

- Oefening – omgekeerd

Geef op de output “576”.



00 101 LOAD 01, REK=199
01 499 SUBTRACT 99, REK=199-123=076
02 300 ADD 00, REK=076+500=576
03 600 OUTPUT
04 700 HALT

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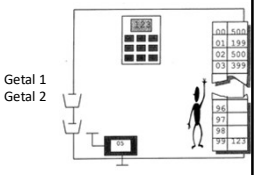
H6 De virtuele computer

- Oefening: druk grootste getal af (getal 1 en getal 2)

00 500	INPUT Getal 1 op REK	
01 298	STORE 98	
02 500	INPUT Getal 2 op REK	
03 299	STORE 99	
04 498	SUBTRACT REK – 98	
05 800	?negatief => SKIP eerstvolgende	
06 920	JUMP 20	
07 198	LOAD 98	
08 600	OUTPUT	
09 700	HALT	
20 199	LOAD 99	
21 908	JUMP 8	



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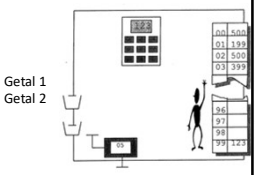
H6 De virtuele computer

- Oefening: druk grootste getal af (getal 1 en getal 2)

00 500	INPUT, REK=Getal 1
01 298	STORE 98
02 500	INPUT, REK=Getal 2
03 299	STORE 99
04 498	SUBTRACT REK – 98, Getal2-Getal1
05 800	SKIP eerstvolgende, ?negatief
06 198	LOAD 99
07 802	SKIP eerstvolgende, ?positief
08 199	LOAD 98
09 600	OUTPUT
10 700	HALT



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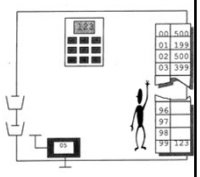
H6 De virtuele computer

- Oefening: afdrukken van klein nr groot (getal 1 en getal 2)

```
00 500  INPUT (Getal 1 op REK)
01 298  STORE 98
02 500  INPUT (Getal 2 op REK)
03 299  STORE 99
04 498  SUBTRACT ("REK" – "98")
05 800  ?negatief => SKIP eerstvolgende
06 920  JUMP 20
07 199  LOAD 99 (kleinste)
08 600  OUTPUT
09 198  LOAD 98 (grootste)
10 600  OUTPUT
11 700  HALT

20 198  LOAD 98 (kleinste)
21 600  OUTPUT
22 199  LOAD 99 (grootste)
23 910  JUMP 10
```

Getal 1
Getal 2



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