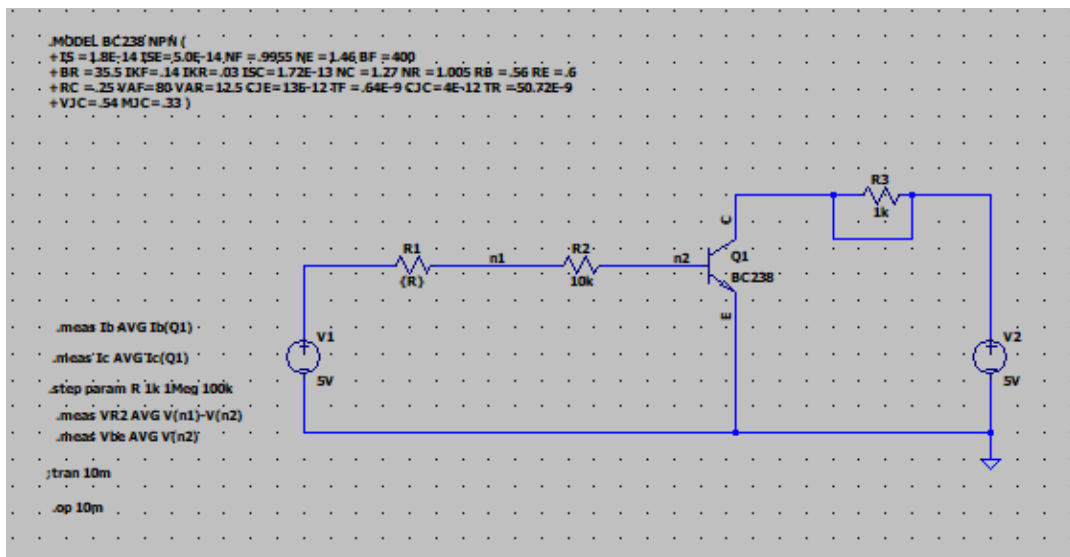
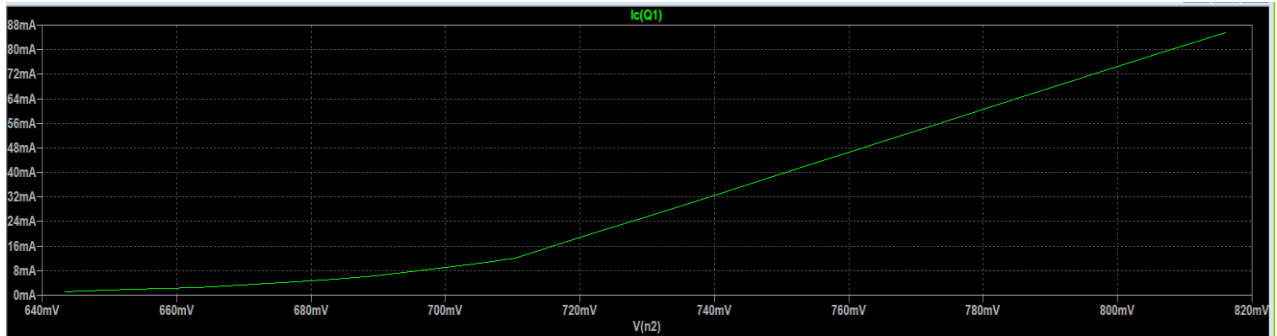


INTRODUCTION TO ELECTRONICS LABORATORY-EXPERIMENT2

Name: Başar Demir

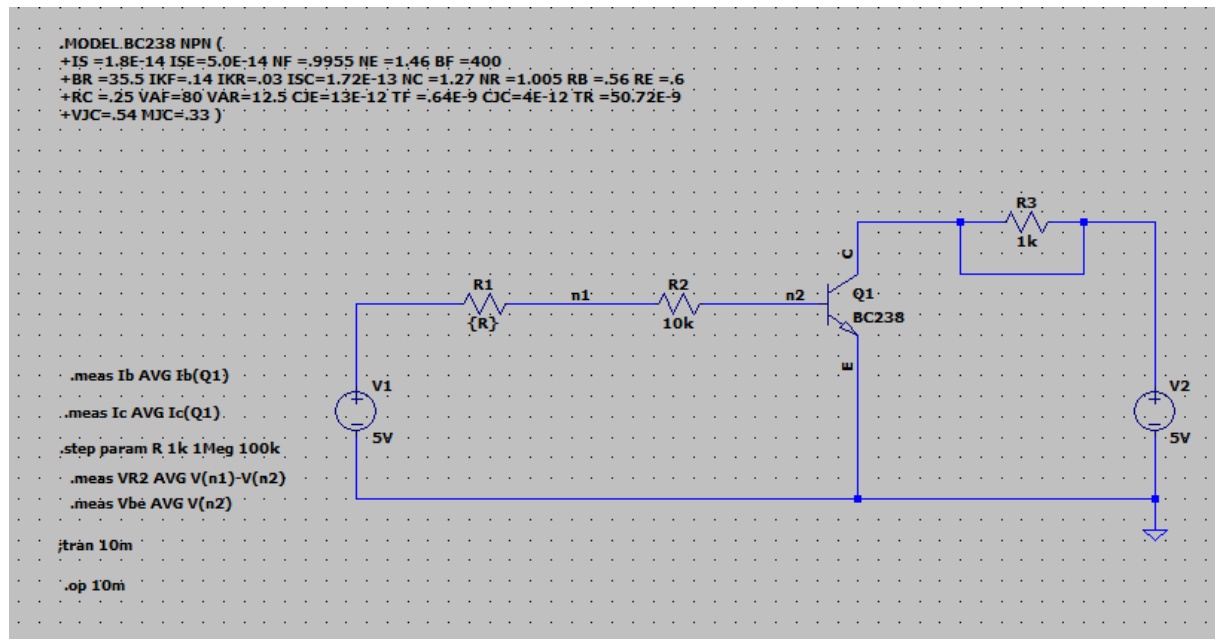
Student Id: 150180080

1)



2)

Forward-Active Mode:



Direct Newton iteration for .op point succeeded.

Semiconductor Device Operating Points:

--- Bipolar Transistors ---

```

Name:      q1
Model:     bc238
Ib:        3.80e-04
Ic:        8.57e-02
Vbe:       8.16e-01
Vbc:       -4.18e+00
Vce:       5.00e+00
BetaDC:    2.25e+02
Gm:        2.40e+00
Rpi:       6.95e+01
Rx:        5.60e-01
Ro:        9.25e+02
Cbe:       1.56e-09
Cbc:       1.96e-12
Cjs:       0.00e+00
BetaAC:    1.67e+02
Cbx:       0.00e+00
Ft:        2.45e+08

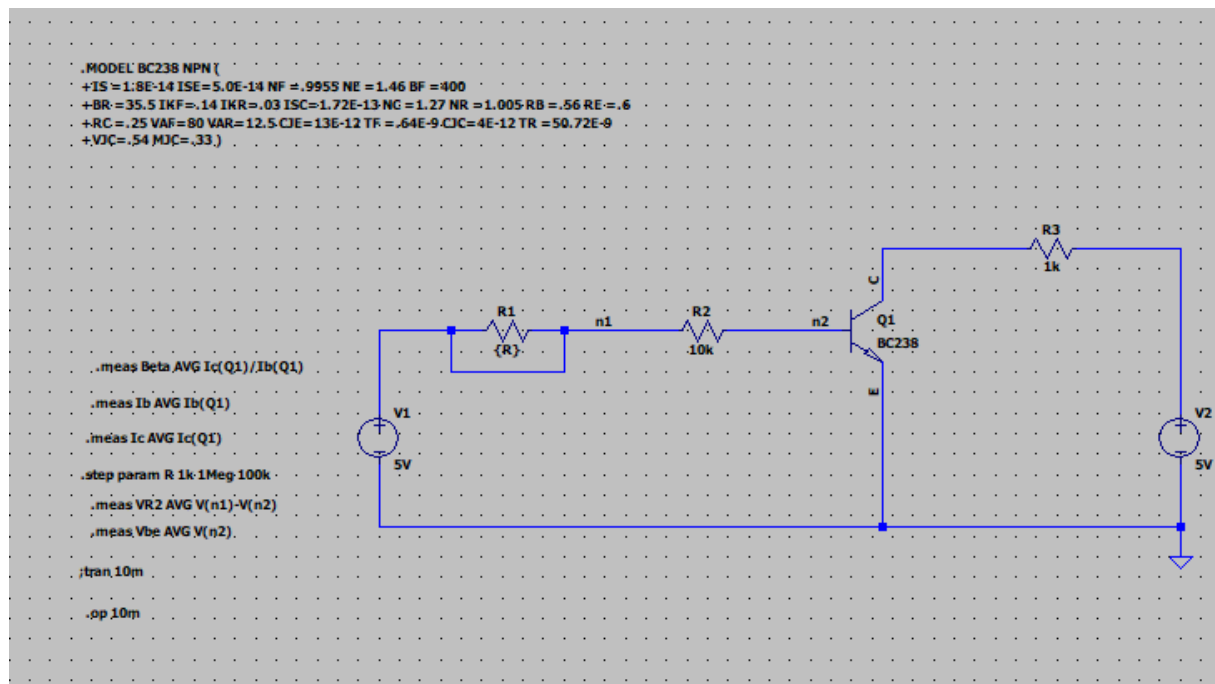
```

```

vr2: AVG(v(n1)-v(n2))=0.307957 FROM 1000 TO 1e+006
vbe: AVG(v(n2))=0.674705 FROM 1000 TO 1e+006
ic:  AVG(ic(q1))=0.0078635 FROM 1000 TO 1e+006
ib:  AVG(ib(q1))=3.07957e-005 FROM 1000 TO 1e+006
beta: AVG(ic(q1)/ib(q1))=292.425 FROM 1000 TO 1e+006
vce: AVG(v(c))=5 FROM 1000 TO 1e+006

```

Saturation Mode:



Circuit: * C:\Users\BASAR-PC\Desktop\2-2-2.asc

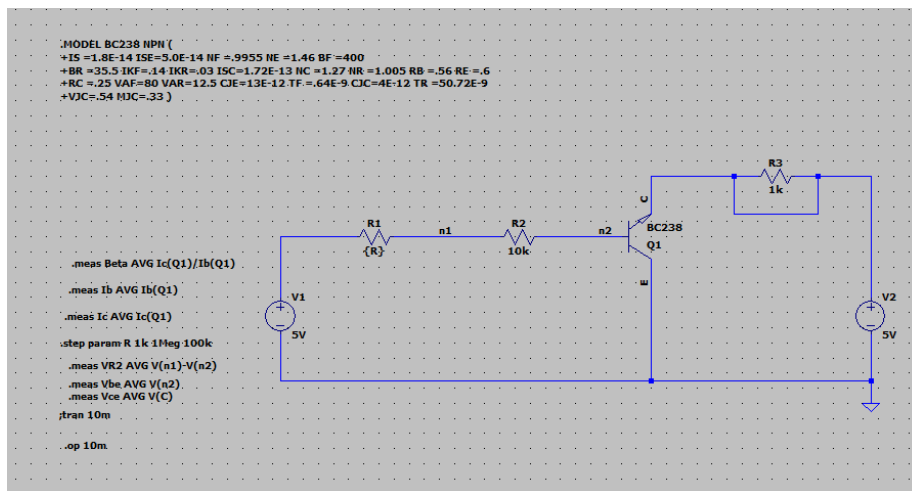
R1: both pins shorted together -- ignoring.
Direct Newton iteration for .op point succeeded.
Semiconductor Device Operating Points:

--- Bipolar Transistors ---

Name: q1
Model: bc238
Ib: 4.29e-04
Ic: 4.98e-03
Vbe: 7.07e-01
Vbc: 6.88e-01
Vce: 1.82e-02
BetaDC: 1.16e+01
Gm: 1.77e-01
Rpi: 7.01e+02
Rx: 5.60e-01
Ro: 5.12e+00
Cbe: 2.53e-10
Cbc: 1.16e-08
Cjs: 0.00e+00
BetaAC: 1.24e+02
Cbx: 0.00e+00
Ft: 2.38e+06

vr2: AVG(v(n1)-v(n2))=4.29339 FROM 1000 TO 1e+006
vbe: AVG(v(n2))=0.706612 FROM 1000 TO 1e+006
ic: AVG(ic(q1))=0.00498175 FROM 1000 TO 1e+006
ib: AVG(ib(q1))=0.000429339 FROM 1000 TO 1e+006
beta: AVG(ic(q1)/ib(q1))=11.6033 FROM 1000 TO 1e+006
vce: AVG(v(c))=0.0182481 FROM 1000 TO 1e+006

Reverse-Active Mode:



Circuit: * C:\Users\BASAR-PC\Desktop\Draft5.asc

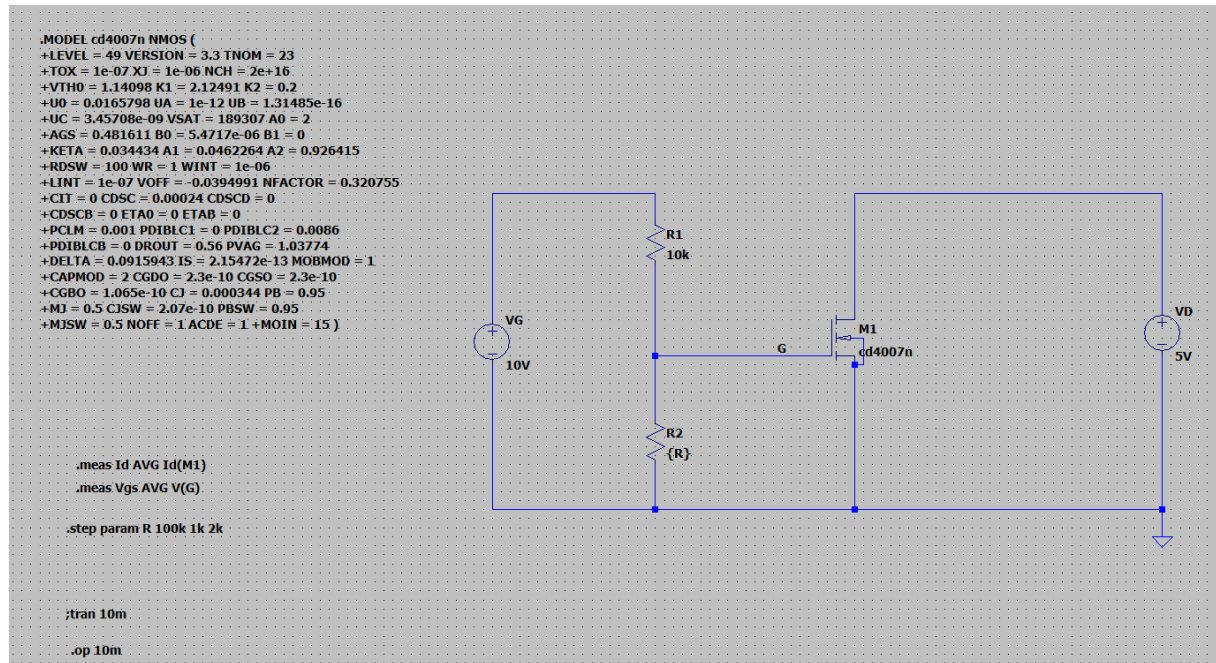
R3: both pins shorted together -- ignoring.
Direct Newton iteration for .op point succeeded.
Semiconductor Device Operating Points:

--- Bipolar Transistors ---

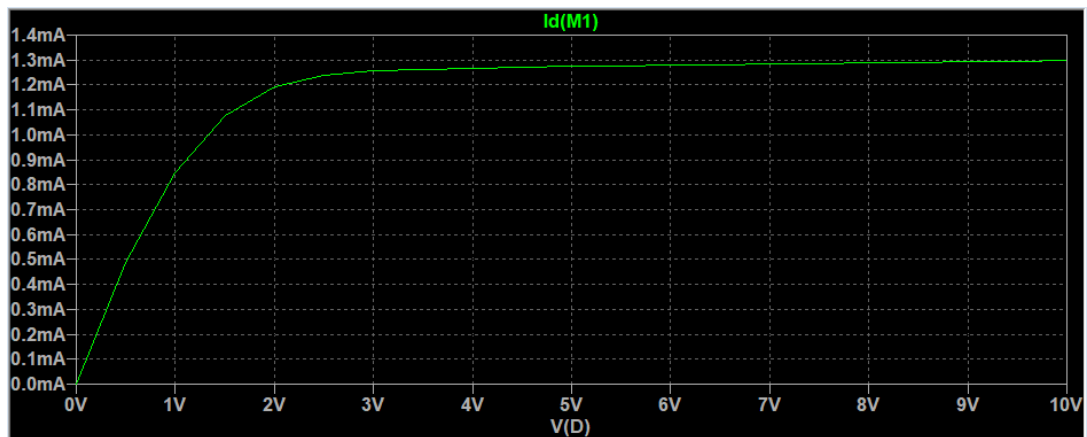
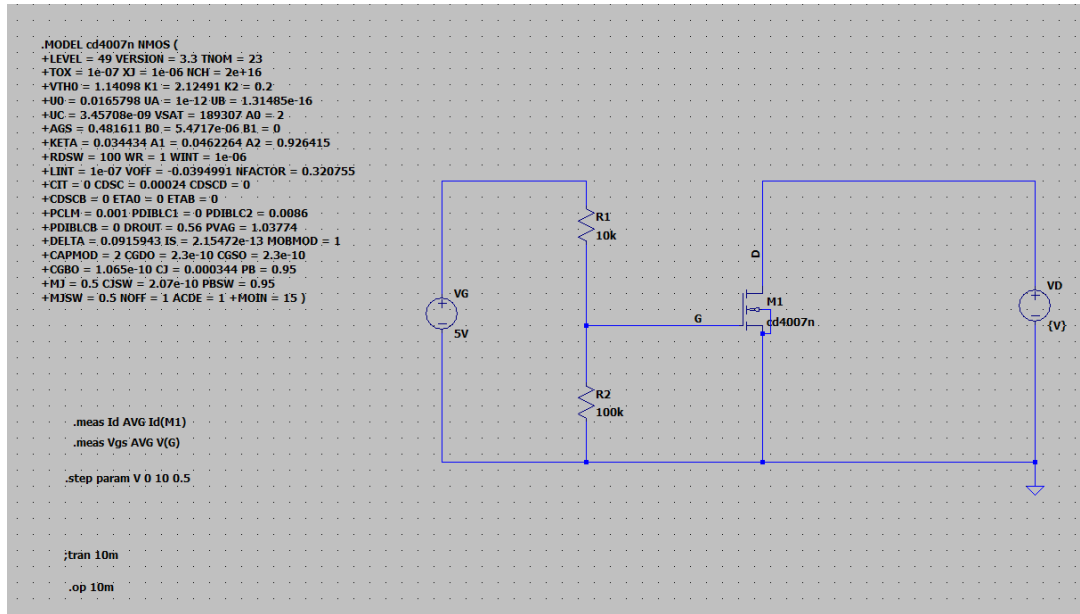
Name: q1
Model: bc238
Ib: 3.92e-04
Ic: -7.18e-03
Vbe: -4.31e+00
Vbc: 6.91e-01
Vce: -5.00e+00
BetaDC: -1.83e+01
Gm: -2.28e-01
Rpi: 1.00e+12
Rx: 5.60e-01
Ro: 4.38e+00
Cbe: 6.93e-12
Cbc: 1.16e-08
Cjs: 0.00e+00
BetaAC: -2.28e+11
Cbx: 0.00e+00
Ft: 3.12e+06

vr2: AVG(v(n1)-v(n2))=0.316054 FROM 1000 TO 1e+006
vbe: AVG(v(n2))=0.583723 FROM 1000 TO 1e+006
ic: AVG(ic(q1))=-0.000518622 FROM 1000 TO 1e+006
ib: AVG(ib(q1))=3.16054e-005 FROM 1000 TO 1e+006
beta: AVG(ic(q1)/ib(q1))=-12.6255 FROM 1000 TO 1e+006
vce: AVG(v(c))=5 FROM 1000 TO 1e+006

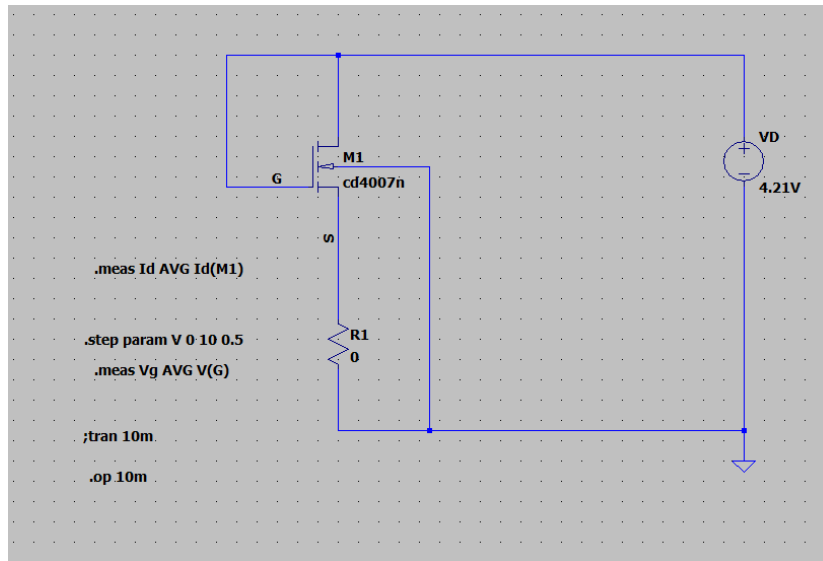
3)



4)



5)



0k -> $V_d = 4.21V$

id: $AVG(id(m1)) = 0.00100065$ FROM 0 TO 10
vg: $AVG(v(g)) = 4.21$ FROM 0 TO 10

1k -> $V_d = 6.332V$

id: $AVG(id(m1)) = 0.00100028$ FROM 0 TO 10
vgs: $AVG(v(g) - v(s)) = 5.33172$ FROM 0 TO 10
vsb: $AVG(v(s)) = 1.00028$ FROM 0 TO 10

2.2k -> $V_d = 8.575V$

id: $AVG(id(m1)) = 0.00101165$ FROM 0 TO 10
vgs: $AVG(v(g) - v(s)) = 6.34938$ FROM 0 TO 10
vsb: $AVG(v(s)) = 2.22562$ FROM 0 TO 10