CSCI 340   HW12

1) **Derive   abba**

S	initial
ABS	①
ABABS	①
ABAB	①ᵇ
ABBA	②
a bba	④,⑤ *

Derive   babbaaab

S	initial
ABS	①
ABABS	①
ABABABS	①
AB ABABABS	①
AB AB ABAB	①ᵇ
BA AB AB AB	③
BA BAABAB	②
BA BABAAB	②
BABBAAAB	②
babbaaab	④⑤ *

Prove EQUAL

① Introduces exactly one A and one B
② Doesn't change # of A's or B's
③ Doesn't change # of A's or B's
④ and ⑤ convert from uppercase to lowercase
② and ③ merely rearrange order of a's & b's

2) ① Relabel S from EQUAL as E
   ② Introduce new S-state :

$$S \rightarrow AS \mid AE$$

DONE

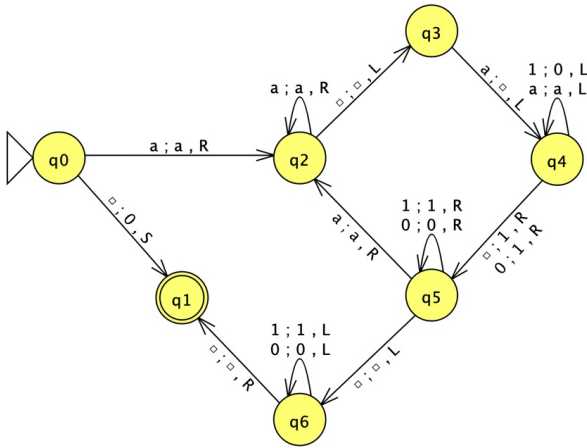3) ① Relabel S from MOREA as M
   ② Introduce new N-state :

$$N \rightarrow BN \mid BE$$

   ③ Introduce new S-state :

$$S \rightarrow M \mid N$$

DONE

4) accepts number in unary and converts to binary

q_2 – go to end
q_3 – erase rightmost a
q_4 – rewind to $\triangle$ or 0
      carry if necessary
q_5 – fast forward to next a
q_6 – no more a's — rewind
      to beginning

---

5) Describe unary exponentiation

$\underbrace{a \,\#\, \text{b-part}}\; \&\; \text{e-part}\; \#$

1) start by writing a $\#$ before the base and exponent
   write a $\#$ after the e-part

2) if e-part empty, erase back until $\#$ seen; rewind to
   beginning ; done!

3) decrement e-part by one

4) <u>multiply</u> lhs-of-$\#$ with b-part and write result to
   the right of the $\#$

5) move/overwrite rhs-of-$\#$ to lhs-of-$\#$

6) goto step $\#2$

6)

m => n => f => x =>   m (n(f)) (x)

n => f => x => N2 (n(f))(x)

f => x => N2(N3(f))(x)

x => N2(N3(succ))(x)

N2(N3(succ))(0)

N3(succ)(N3(succ)(0))

N3(succ)(succ(succ(succ(0))))

N3(succ)(3)

succ(succ(succ(3)))

6

m → N2

n → N3

f → succ

x → 0

N2(y)(z) → y(y(z))

N3(succ)(0) → succ(succ(succ(0)))

succ(succ(succ(0))) → 3

N3(succ)(3) → succ(succ(succ(3)))

succ(succ(succ(3))) → 6