

**PUBLICATIONS (Peer-reviewed):** *VXHQV VXSIUYWVH EUI XQHIUQIH*

\*++) ?RdaVcd% 8'% **Hopcroft, R.R.**% @Z`cS`V% I`A`^SRcU% ;`A`aVk&JccfeZR% 6% :gVcVee% ?'9' !  
GZTYRcUd`\_ 6' ?' #+)+, \$ <V]ReZ`\_ fd ]RcgRTVR\_ k` `a]R\_ \e` \_ TR\_ V\_YR\_TV ec` aYZT ecR\_dWVc R\_U TRcS` \_  
dVbfVdecReZ` \_' *AUIQHV 4GR0% 4YR0%*

\*+\* ' 8`eVR >d]Rd% = 'B' ! **Hopcroft, R.R.** +)+, ' 6Sf\_UR\_TV% T` ^a`dZeZ` \_ R\_U UZdecZSfeZ` \_ `W acVURe`cj  
XV]ReZ`\_ fd k` `a]R\_ \e` \_ Z\_ eYV C` ceYVc\_ <f]W `W 6]Rd\R' 9% >0EQNWRQ ?IV# **45**, /2, &0)1'

\*+) ' B`\_ V]|| @'?'% G`\_ TR]]Z% K% **Hopcroft, R.R.**% =Rce]Z\_V% 9'@' ! AV\_k% E'=' +)+, ' E`de&9ZRaRfdV 9C6  
GVa]ZTReZ`\_ UfcZ\_X D` XV\_VdZd Z\_ R 8RaZeR] & 7cVVUZ\_X 8` aVa`U' 8QWIKUEWYI =UK% IWR0% **5**: `SRU)+)'

\*\*2' 8fdYZ\_X% 9'6% @f]Vek% @'?'% H` fdR% A% 9Rj% G'=' 9R\_ZV]d`\_% H'A'% ARSf\_d\Z% : '6' ! **Hopcroft,**  
**R.R.** +)+, ' 9ZWWVcV\_eZR] cVda`\_dV `W dVRSZcU daVTZVd e` hRc^&R\_U T` ]U&hReVc VgV\_ed Z\_ R YVeVc` XV`\_ fd  
Tc`dd&dYV]W V\_gZc`\_ ^V\_e Z\_ eYV <f]W `W 6]Rd\R' ; *EU% 4GR0% >URK% @IU%*

\*\*1' B`\_ eV\_VXc`% ?'% 8`]]Z\_d% 6' <'% **Hopcroft, R.R.**, FfvdeV] ?' B' % IYfVdV\_% : 'K' % 7RTYeV] % I'H%  
7VcX^R\_% A'6% HR\_XV\Rc% B'C' % 9cRkV\_% ?'8' ! AZ\_UdRj% 9'?' +)+, ' =VeVc` XV\_VZej Z\_ UZR\_X`\_ deZT  
TYRcRTeVcd RT >> R =VeV\_U UzD\_ R ( ( RX\_

\*)O' @`d`S` \ `gR% @'C' ! **R.R. Hopcroft.** +)+\* E` af]ReZ` \_ decfTefcV% gVceZTR] UZdecZSfeZ` \_% R\_U WVTf\_UZej  
`W 4XNURLQME LEPEWE #8YRVe`X\_ReYR\$ Z\_eYV 6cTeZT DTVR\_ UfcZ\_X df ^ ^Vc' 3 IIS\$@IE ?IV% 8% 1693  
\*), - . -

\*)/'A@Z^fcR% ; '% N' 6SV% @' B Redf\_`% **R.R. Hopcroft** ! 6' NR^RXfTYZ' +)+)' IV^a`cR] TYR\_XVd `W  
k` `a]R\_ \e` \_ T` ^ ^ f\_Zej R\_U a`af]ReZ` \_ decfTefcV Z\_eYV \_ `ceYVc\_ 7VcZ\_X HVR Wc` ^ ?f\_V e` HVaeV^SVc  
Z\_+)\*O' 3 IIS @IE ?IV% 88% 181-1823 \*)-2)\*

\*) . **R.R. Hopcroft** 8' ARAR\_UV% 9'6' He`T\ hV]]% 6' B'E  
BT9` \_\_V]]' +)+)' : iecR`cUZ\_Rcj TRcS` \_ W]fiVd` \_ eYV dYR]]` h ERTZWZT 6cTeZT dYV]W UfcZ\_X R  
cV^Rc\RS]j hRc^ R\_U ]` h dVR ZTV aVcZ`U' ;c`\_eZVcd BRc' HTZ' 7: 21/

\*)-' FfVdeV]] ?' B % G' G' = `aTc`We% = ' B' 9V=Rce% 8' 6' H^` `e% @' C' @`d`S` \ `gR% R\_U 6' 7ft\]Z\_'  
+)+\*' B VeRSRcT`UZ\_X `W k` `a]R\_ \e` \_ UzgVcdZej hZeYZ\_eYV 8Yf\TYZ 7`cUVc]R\_Ud% 6cTeZT DTVR\_3  
>^ac`gVU cVd` ]feZ` \_ Wc` ^ ^ f]eZ&XV\_V ^Rc\Vcd R\_U cVXZ` \_&daVTZWZT 9C6 UReRSRdVd' ; EU% IMRHMY% 51:-

\*) , ' 7]fY^% 7'6% B'6' ?R\_`fe% H'A' 9R\_ZV]d` \_% >' : ]]Z\_XdV\_% B' <RgcZ]`% ?' B' <cVS^VZVc% **R.R.  
Hopcroft** @' >\V\_% G'7' >\_XgR]UdV\_% A'A' ?ncXV\_dV\_%% @'C' @`d`S` \ `gR% G' @h` \ % >'K' E` ]jR\`g%  
E': 'GV\_RfU% ! : '8' 8Rc^RT\'+)+)' IYV aR\_&6cTeZT T`\_eZ\_V\_eR] d]`aV3 dYRca XcRUZV\_ed `W aYjdZTR]  
ac`TVddVd RWWWTe aV]RXZT R\_U SV\_eYZT VT`d]deV^d' 5URO% IUV ; EU% @GM% 7: . - , 1/

\*)+' Azy` B' 6# B' Qs, a] dZT \$fcmý ?OL RcuRyuaDm Fca]Dh' y.R \$eQ5 'Dä - ■ PTM5H@y Oy.5 Q, H } Oñ ð ° à

2, 'GfekV %>'% ! **R.R. Hopcroft**' +)\*1' 6Sf\_UR\_TV% SZ` ^Rdd R\_U T` ^ ^ f\_zej decfTefcV `W VaZaV]RXZT  
k` `a]R\_ \e` \_ Z\_ eYV 8R\_RUR 7RdZ\_ '9% >0EQNWRQ ?IV% **40:** -1/&-22'

00' CZXc`% A'B '% B'K' 6\_XV]@' 7JRTY` hZR\&HR^`]j\% **R.R.**

/-' 8`j]V% @'D%' <'6' <ZSd`\_@' =VUdec` ^% 6' =Vc ^R\_\_% ! **R.R. Hopcroft.** +)\*,' O` `ajR\_\e` \_  
SZ` ^Rdd% RUGvTeZ` \_R\_U ac`UfTeZ` \_` \_eYV \_`ceYVc\_ <f]W `W 6]Rd\R dYV]W Wc` ^ dz ^ f]ReZ` \_d R\_U WZV]U  
`SdVcgReZ` \_d' 9% ; EU% @/V% **1283** \*1.&+)0'

/,' 9Rj% G'=% I'?' L VZ\_XRce\_Vc% **R.R. Hopcroft** A'6'B' 6Vced% 6'A' 7]R\_TYRcU% 6': ' <R]]% 7'?'  
<R]]Rhrj% 9': ' =R\_\_Rj% 7'6' =`]]RURj% ?'I' BReYZd% 7'A' C`cTc`dd% ?'B' FfVdeV]]% ! H'H' LZdU` ^'  
+)\*,' IYV` WwdY`cV \_`ceYVRdeVc\_ 8Yf\TYZ HVR3 R T` ^a]Vi YZXY&]ReZefUV djdeV ^' 2RQW% @LI0J ?IV% **673**  
\*-0&\*/.'

/+' FfVdeV]]% ?'B'% 8' 8]Rc\V% ! **R.R. Hopcroft**

- .)' **Hopcroft, R.R.** ! '@'C' @`d`S` \ `gR' +)\*)' 9ZdecZSfeZ` \_R\_U VXX ac`UfTeZ` \_ `W >VIXHRGE0EQXV  
daVTZVd Z\_ eYV 8Yf\TYZ HVR' 3 IIS\$@IE ?IV% 88% 573-2& ./
- 2' **Hopcroft, R.R.**, '@'C' @`d`S` \ `gR ! 6>'EZ TYf\'+)\*)' O` `a]R\_ \e` \_ T` ^ ^ f\_Zej aReeVc\_d Z\_ eYV  
8Yf\TYZ HVR UfcZ\_X df ^ ^ Vc +))-' 3 IIS\$@IE ?IV% 88% 573 +0&, 2
- 1' @`d`S` \ `gR% '@'C' ! **R.R. Hopcroft** +)\*)' 9ZgVcdZej R\_U gVceZTR] UZdecZSfeZ` \_ `W ^Vd`k` `a]R\_ \e` \_ Z\_  
d 8R\_RUR 7RdZ\_ ' 3 IIS\$@IE ?IV% 88% 573 2/&\*\*)
- 0' GRd\`W% '@'6% **R.R. Hopcroft** '@'C' @`d`S` \ `gR% ?:' EfcTV]] ! B' N` f\_XS]feY' +)\*)' ?V]]ZVd f

, , ' AZf% == ! R.R. Hopcroft' +)) /' <c` heY R\_U UVgV]` a ^V\_e `W <IRGE0EQXV J0IPWQKIUM&S0XPGLUXV Z\_ eYV \_`ceYVc\_ <f]W `W 6]Rd\R3 gRjZUReZ` \_ `W eYV RceZWTZR] T`Y`ce ^VeY`U Z\_ T` JU hReVcd' 9% >0EQNWRQ ?IV% 283 10&\*)\*%  
, + ' Hopcroft, R.R.% ! 7'=' G`SZd` \_' +)) . ' CVh ^Vd` aV]RXZT ]RcgRTVR\_d Z\_ eYV XV\_fd 5UMW00EUME Wc` ^ B` \_eVcVj 7Rj% 8RjZW` c\_ZR' 9% ; EU% IMR0% OVVRG% 853 // .&/01'  
, \*' CRaa% ?' B` % R.R. Hopcroft% 8'I' 7RZvc ! 8' 8]Rc\ V +)) . ' 9ZdecZSfeZ` \_ R\_U daVTZVd&daVTZWZT VXX ac` UfTeZ` \_ `W >VIXHRGE0EQXV Z\_ eYV <f]W `W 6]Rd\R' 9% >0EQNWRQ ?IV% 273 -\*. &-+/'  
, )' Hopcroft, R.R.% 8' 8]Rc\ V% G'?' CV]d` \_% ! @'6' GRd\` WW' +)) . ' O` `a]R\_ \e` \_ 8` ^ ^ f\_ ZeZVd `W eYV 6cTeZTd 8R\_RUR 7RdZ\_3 eYV T` \_ecZSfeZ` \_ Sj d^Rj]Vc eRiR' >R0EU IMR0% 28: \*20&+)'  
+2' Hopcroft, R.R.% 8' 8]Rc\ V% 6' <' 7jcU ! 6' >' EZ\_TYf\` +)) . ' IYV aRcRU` i `W ; IWUMHE daa' VXX ac` UfTeZ` \_ cReVd3 6 \_Vh eVTY\_ZbfV R\_U ^VRdfcV ^V\_e dWc` ^ eYV T` RdeR] <f]W `W 6]Rd\R' ; EU% 4GR0% >URK% @IU% 2863 \*2, &+)\*'  
+1' GRd\` WW% @'6' % ?' : ' EfcTV]] ! R.R. Hopcroft. +)) . ' <V]ReZ` \_ fd k` `a]R\_ \e` \_ `W eYV 6cTeZT DTVR\_3 MQ WWX `SdVcgReZ` \_ d f\_UVc eYV ZTV' >R0EU IMR0% 28: +)O&+\*0'  
+0' H]ReVc% A'B' ! R.R. Hopcroft. +)) . ' 9VgV]` a ^V\_e% Xc` heY% R\_U VXX ac` UfTeZ` \_ `W 2IQWURSEKIV EFHRPMQE0NV Z\_ eYV dfSRcTeZT ERTZWZT' 9% >0EQNWRQ ?IV% 273 0\*01'  
+/' Hopcroft, R.R. +)) . ' 9ZgVcdZej Z\_ ]RcgRTVR\_d3 = `h ^R\_j daVTZVd5 aa' - .&.O' 8Q/ GVda` \_dV `W ^RcZ\_V VT` djdeV ^d e` X]` SR] TYR\_XV3 VT` ]` XZTR] Z^ aRTe `W RaaV\_UZTf]RcZR\_d' <` cd\j% <% B'?' N` f\_XS]feY ! 9' 9VZSV] #VUD% <` cU` \_ R\_U 7cVRTY HTZV\_eZWZT EfS]ZdYVcd' ERcd'  
+.' G`dV% @' % ?'8' G` WW ! R.R. Hopcroft' +)) -' Ec` UfTeZ` \_ `W >IQMOME EYMURVWUMV Z\_ @Z\_Xde` \_ =RcS` fc% ?R^RZTR' 9% >0EQNWRQ ?IV% 263 /) .&/ \*.'  
+-' Hopcroft, R.R.% ! ?'8' G` WW' +)) , ' GVda` \_dV `W ec` aZTR] ^RcZ\_V aYje` a]R\_ \e` \_ T` ^ ^ f\_ ZeZVd e` ^R\_Zaf]ReZ` \_ d `W \_fecZV\_e T` \_TV\_ecReZ` \_ R\_U XcRkZ\_X acVddfcV' IX00% ; EU% @GM% 733 , 20&-+)  
+, ' EVcdRU% <% R.R. Hopcroft% B'@' L\_VSSVc ! ?'8'G` WW' +)) , ' 6Sf\_UR\_TV% SZ` ^Rdd R\_U ac` UfTeZ` \_ `W TeV` \_ aY` cVd R\_U ^VUfdRV `WW @Z\_Xde` \_ ?R^RZTR' IX00% ; EU% @GM% 733 , 02&, 2/  
++' Hopcroft, R.R., 8' 8]Rc\ V ! ; 'E' 8YRgVk' +)) +% 8` aVa` U T` ^ ^ f\_ ZeZVd Z\_ B` \_eVcVj 7Rj UfcZ\_X eYV \*220 e` \*222 : ] CzM` R\_U AR CZmR' >URK% =GIEQRKU% 543 +. \*&+/' ,  
+\* ' LVZ\_XRce\_Vc% I'?' IW E0% #R.R. Hopcroft R^` \_X \*1 `eYVcd\$ +)) +% IYV C` ceYVRde ERTZWZT <AD7 : 8 ac` XcR^3 T` RdeR] <f]W `W 6]Rd\R' =GIEQRKUESL[ 153 -1&/ ,'  
+) ' CZV]dV% I' <% ; ; ' Bn]]Vc% H' HReRa` ` ^Z\_% B' GZ\_XfVee ! R.R. Hopcroft' +)) +) : XX YReTYZ\_X cReV `W eYV TjT]` a` ZU T` aVa` U =MWRQE VMPMOMV Z\_ RcTeZT R\_U eV^ aVcReV hReVcd' ; EU% 4GR0% >URK% @IU% 2363 , ) \*& , ) /'  
\*2' BRcZ\_V O` `a]R\_ \e` \_ 8` ]] `bfZf^ +` +)) \*' #R.R. Hopcroft R^` \_X -) T` \_ecZSfe` cd\$ ; ffcV ^RcZ\_V k` `a]R\_ \e` \_ cVdVRcTY R aVodaVTeZgV' ; EU% 4GR0% >URK @IU% 2223 +20&, ) 1%  
\*1' Hopcroft, R.R., ; 'E' 8YRgVk ! ?'8' G` WW' +)) \*% HZkV aRcRUZX^d Z\_ T` aVa` U T` ^ ^ f\_ ZeZVd3 R cV& ViR^Z\_ReZ` \_' 7[HURFWR0RKME 453/4543\* , , &\* - \*'  
\*0' Hopcroft, R.R.% ! 7'=' G`SZd` \_' \*222' 6 \_Vh ^Vd` aV]RXZT ]RcgRTVR\_% ; IVRGLRUHEIXV IU[WLURGISLE0XV] da' \_`g` Wc` ^ B` \_eVcVj 7Rj% hZeY UVdTcZaeZ` \_ `W Zed WZ]eVcZ\_X Y` fdV' 9% >0EQNWRQ ?IV% 213 \*2+, &\*2, 0'  
\*/' Hopcroft, R.R.% ! ?'8' G` WW' \*221' O` `a]R\_ \e` \_ Xc` heY cReVd3 eYV Z\_W]fV\_TV `W WV^RjV dZkV R\_U cVd` fcTVd ` \_ VXX ac` UfTeZ` \_ `W ec` aZTR] ^RcZ\_V T` aVa` Ud' ; EU% IMR0% 1323 02&1/'

- \*.' **Hopcroft, R.R.** ! ?'8' G`WW' \*221' O` `a]R\_\e`\_ Xc` heY cReVd3 eYV Z\_W]fV\_TV `W dZkV Z\_\_Rfa]ZZ `W ec`aZTR] ^RcZ\_V T` aVa`UZeVd' ; EU% IIR0% **1323** 10&2/'
- \*-' **Hopcroft, R.R.** ! ?'8' G`WW' \*221' Ec`UfTeZ`\_ `W ec`aZTR] ]RcgRTVR\_d Z\_ @Z\_Xde`\_ =RcS` fc% ?R^RZTR3 ReV hV ZX\_`cZ\_X R\_ Z^a`ceR\_e dVT`\_URcj ac`UfTVc5 9% >0EQNWRQ ?IV% **203** . .0&./2'
- \*, ' **Hopcroft, R.R.** ?'8' G`WW' ! = '6' 7`f^R\_' \*221' O` `a]R\_\e`\_ Xc` heY cReVd3 ]RcgRTVR\_d `W eYV XV\_fd OSSIQHMGXOEUME% 5UMWMOOEUME R\_U =MNRSOIXUE Wc` ^ ec`aZTR] hReVcd' 9% >0EQNWRQ ?IV% **203** . ,2&...'
- \*+' **Hopcroft, R.R.** ?'8' G`WW' ! 9' A`^SRcU' \*221' Ec`UfTeZ`\_ `W ec`aZTR] T` aVa`Ud Z\_ \_VRcdY`cV hReVcd `WW @Z\_Xde`\_ ?R^RZTR3 eYV Z^a`ceR\_TV `W d^R]] daVTZVd' ; EU% IIR0% **1303** .2,&/)-'
- \*\*' **Hopcroft, R.R.** ?'8' G`WW' B '@' L VSSVc% ! ?'9'H' LZee' \*221' O` `a]R\_\e`\_ <c` heY GRcVd3 eYV Z\_W]fV\_TV `W dZkV R\_U cVd` fcTVd Z\_ ec`aZTR] ^RcZ\_V T` aVa`UZeVd' ; EU% IIR0% **1323** /0&00'
- \*)' I fc\_Vc% ?'I' % **R.R. Hopcroft** ?'6' AZ\_T`\_]\_ 8' HRdd^R\_ =fVdeZd% E'6' IVdeVc% ! ?'8' G`WW' \*221' O` `a]R\_\e`\_ WVVUZ\_X VT` ]`Xj3 XcRkZ\_X Sj ^RcZ\_V T` aVa`Ud R\_U T]RU`TVcR\_d fa`\_ TjR\_`SRTcVcZR Wc` ^ @Z\_Xde`\_ =RcS` fc% ?R^RZTR' ; EU%4GR0% **193** \*2.&+)1'
- 2' **Hopcroft, R.R.** ! ?'8' G`WW' \*22/' O` `a]R\_\e`\_ Xc` heY cReVd3 UZV] VXX ac`UfTeZ`\_ Z\_ eYV T` aVa`Ud =MRLRQE% 4XW IUSWQE R\_U 2RU[GEIXV Wc` ^ ec`aZTR] hReVcd' 9% >0EQNWRQ ?IV% **183** 012&1) , '
- 1' **Hopcroft, R.R.** ! ?'8' G`WW' \*22.' O` `a]R\_\e`\_ <c` heY GRcVd3 : iecR`cUZ\_Rcj ac`UfTeZ`\_ Sj eYV ]RcgRTVR\_ =MNRSOIXUE HMRMGE Z\_ ec`aZTR] hReVcd' 9% >0EQNWRQ ?IV% **17**



1' 7]fY^% 7'6%' G'G' <cRUZ\_XVc ! **R.R Hopcroft** +)\*\*\*' 6cTeZT DTVR\_ 9ZgVcdZeJ3 dj\_eYVdZd' ; EU% IMRHMY%  
41: \*&-

0' HTYZRaRcV]]Z% H' ! **R.R. Hopcroft.** +)\*\*\*' IYV 8V\_dfd`W 6\_eRcTeZT BRcZ\_V AZWV3 9ZgVcdZeJ R\_U 8YR\_XV  
Z\_H` feYVc\_ DTVR\_ :T` djdeV`d' 3 IIS\$@IE ?IV% 88% 58: \*&-

/' <cRUZ\_XVc% G' 7'6' 7]fY^% **R.R. Hopcroft**% 6' <VScf\% @'C' @`d`S`\`gR% 7' HzcV\_\`% ! ?'B'  
L ' +)\*)' BRcZ\_V AZWV\_Z\_eYV 6cTeZT' >\_3 6'9' 9' BT>\_ejcV' #VUS %  
7]RT\hV]] EfS]ZdYZ\_X AeU% CVh N`c\% aa\*1, &+)+

.' 7]fY^% 7'6%' @>\\_V% **R.R. Hopcroft.** +)\*)' DSDVcgReZ`\_d R\_U Via]`cReZ`\_`W eYV 6cTeZT`d 8R\_RUR  
7RdZ\_R\_U eYV 8Yf\TYZ HVR3 eYV =ZUUV\_ DTVR\_ R\_U G J H 6 A 8 6 ViaVUZeZ`\_d% 3 IIS\$@IE ?IV% 88% .03\*&  
\*\_

- ' 9Rgzd% 8' H' ! **R.R. Hopcroft** +)\*)1' IYV UcZWeVcd' =GIEQ 6 IRKU% ; EK%# **July 2008**%, &-)'

, ' 7]fY^% 7' 6%' G' <cRUZ\_XVc% ;' =oe^R\_ % **R.R. Hopcroft**% 6' <cVScf\ ! 7'> HZcV\_\`% +)\*)1' :Z\_  
OV\_dfd UVd BRcZ\_V\_ AVSV\_d Z\_ UVc 6c\`eZd' IMR0% XQVIUUT DIMW 38: -)&-2'

+ ' 8cR\_V% @% ?' E`eeVc ! **R.R. Hopcroft** OUGWIG ?IV% B%@%  
193 ,&\*)

\*' **Hopcroft, R.R.** +) , ' HaZ\_V]Vdd h`\_UVcd3 eYV aV]RXZT WRf\_R' 2XUUIQW/9% ; EU% 4H% 193 \*)&+\*

### MAJOR REPORTS:

\*+ ' 6 fdeVc% E'% 8]Rc\% B' G'% =R]]&HaV\_TVc% ?%' =`aTc`We% G' G'% >\_XV]d% ?%' AVgz`\_A' 6'% B VeRiRd% 6'% Ve R]'  
+)+)' 8YRaeVc OA' 8`\_eZ\_V\_eR] H]` aVd R\_U Hfs^RcZ\_V 8R\_j`\_d' 8Q L`c]U DTVR\_ 8`f\_TZ] & HVT`\_U  
6ddVdd^V\_e GVa`ce' aa'-, 0&- .+'

\*\*' BR]`\_V% I'% 6kkRc`% B' =`aTc`We% G' G'% ERc\% 8% IRU`\`c`% @% IY`c\_Uj\]V% B'% R\_U N`% H' +)\*)'  
8YRaeVc / 6' EJR\_`e`\_`#EYje`a]R\_`e`\_`O`\_`a]R\_`e`\_` 7RTeVcZR R\_U KZcfdVd\$' 8Q L`c]U DTVR\_ 8`f\_TZ] &  
HVT`\_U 6ddVdd^V\_e GVa`ce' aa'\*\*\*. &\* -)

\*)' A`gV[\`j% 8% 8' g`\_ FfZ]]WV]Ue% **R.R. Hopcroft** B' E`f]Z`\_ B' IYR]Vc% 6' 6cV\_Ue% = ' 9VSVd% 6'  
<Zd]Rd`\_R\_U @'C' @`d`S`\`gR' +)\*)' EJR\_`e`\_` ERXVd / , &11 MQ 8 6 ; ; % VUZe`c' HeReV`W eYV 6cTeZT  
BRcZ\_V 7Z`UZgVcdZeJ GVa`ce' 8`\_dVcgReZ`\_`W 6cTeZT ; ]`cR\_R\_U ; Rf\_R#8 6 ; ; % 6\fcVjcZ% >TV]R\_U'

2' H\_V]Xc`gV% E%' : ' K' 7VcXYV% E' BZ]`d]RgZTY% E' 6cTYR^SRf]e% > 7RZ]]j% 6' 7cR\_Ue% 6' 7fT\]Z`\_ B'  
8]Rc\% ; ' 9RYU`fY&<fVSRd% E' =R]aZ`\_ **R.R. Hopcroft** @' @RdTY\_Vc% 7' ARdTV]]Vd% A' 6' AVgz`\_H'  
BV\_UV\_&9VfVc% 6' B VeRiRd% 9' DSfcR% G' G' GVVgVd% I' Gj\_VRcd`\_` @' He`T`d% B' IRckZR% 9'  
IzeeV\_d`c% K' I f\_\_ZT]ZWWV% 7' L R]]RTV% G' L R\_]Vdd% I' LVSS% E' 7Vc\_R]%' GZTV% ! 6' G`dV\_SVcX' +)\*)' /  
8YRaeVc , -' <]`SR] EReeVc\_d Z\_ BRcZ\_V 7Z`UZgVcdZeJ' ERXVd \* &, 0 MQ IYV ; Zcde <]`SR] >\_eVXcReVU BRcZ\_V  
6ddVdd^V\_e #L`c]U DTVR\_ 6ddVdd^V\_e >\$' J\_ZeVU CReZ`\_d% CVh N`c\`

1' BZ]`d]RgZTY% E%' I' LVSS% E' H\_V]Xc`gV% : ' K' 7VcXYV% @' @RdTY\_Vc% E' C' =R]aZ`\_ G' G' GVVgVd% 7'  
ARdTV]]Vd% B' IRckZR% 7' E' L R]]RTV% C' 9f]gj% 8' 6' HZ`aWV\_U`cWVc < HTYZ]]Z\_XVc% 6' 7`fdeR\_j% 7'  
7' 8`]]VeeV% ?' : ' <cRgVd% 9' DSfcR% B' : UhRcUd% B' 8]Rc\% @' He`T`d% I' B`cRe`% K' I f\_\_ZT]ZWWV% **R.R.**  
**Hopcroft** E' 6cTYR^SRf]e% E' EVaZ`\_ ?' ?' Y\_ L' I f\_\_V]]% ; ' B`cVekd`Y`\_ : ' : dT`SRc&7cZ`\_Vd% ='  
D[RgVVC% ?' <`SZ`\_ B' CR\R`\R% @' ; f[Z]fcR% = ' NR^R`\_`M' AZ% @' KV\_`ReRc^R`\_ 8' GRXYf\_ReYR`\_  
8' A' <cZWWZeYd% C' ?' 7Ri% 6' ?' 7fe]Vc% 6' 7cR\_Ue% = ?' <cZWWZeYd% ! ?' GZTV' +)\*)' / 8YRaeVc , . : ieV\_e  
`W 6ddVdd^V\_e `W BRcZ\_V 7Z`]`XZTR] 9ZgVcdZeJ' ERXVd \* &. 1 MQ IYV ; Zcde <]`SR] >\_eVXcReVU BRcZ\_V  
6ddVdd^V\_e #L`c]U DTVR\_ 6ddVdd^V\_e >\$' J\_ZeVU CReZ`\_d% CVh N`c\`

0' BZTYV] 8% ?' GZTV% 7' 7]fY^% 8' 9fRceV% K' <R]]fTZ% I' <Rde`\_`% ; ?' A' <`cUZ]]`% G' <cRUZ\_XVc% **R.R.**  
**Hopcroft** C' ?V\_dV`\_ @' B fde`\_V`\_ I' B fde`\_V`\_ I' <' CZV]dV`\_ 6' CZV^Z% = ' Gf\_V H\[\` JUR] #+)\*, \$

6cTeZT BRcZ\_V :T`djdeV^d' >\_3 +)\*,#VU'\$ 6cTeZT 7Z`U