



# **ARTS2631**

#hYfa YX]UhY '>UdUbYgY '6

HYfa "H\fYY" ## "&\$&\$

## 7ci fgY'Cj Yfj ]Yk

### GHJZ:7cbHJWh:8YHJ]`g

### 7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`] <b>m</b>	@cWUh]cb	D∖cbY
Gia]_c <sup>:</sup> ∄XU	g"]]XU4 i bgk "YXi "Ui	H65 cb A ccX Y	A cfj Yb 6fck b	- ' , ) '' +( )
			&+&	

#### Hi hcfg

B Ua Y	9a U]`	5j U]`UV]`] <b>m</b>	@cWJh]cb	D\cbY
5hca]"C\UaU	U"c\Ua U4 i bgk "YXi "Ui		A cfj Yb <sup>·</sup> 6fck b &\$(	-',)"+*"
BcVi U_] <sup>:</sup> 5_U[]	b"U_U[]4 i bgk "YXi "Ui		A cfj Yb <sup>*</sup> 6fck b &\$(	-',)"+*"

### GWXcc`7cbHJWhi±bZcfa Uh]cb

GWkcc`cZ<iaUb]hJYg'UbX'@Ub[iU[Yg

@c\\U||cb. G\\cc`C\\Z|\\\ž\Acfj\b'6fck\b'6i]\X]b[\z'@\j\Y`\&z\&),

CdYb]b[ '<ci fg. 'A cbXUm!': f]XUmž'-Ua '!') da

D\cbY.'Ž\*%'&'-',)'%\*,%

: UI . Ž\*%'&'-',) ', +\$)

9a U]`.`\<u>U`4 i bgk "YXi "Ui</u>

7ci fgY<sup>-</sup>8YHJ]`g

7fYX]hDc]bhg\*\*

Gi a a UfmcZh\Y 7ci fgY

 $H\Y'Wci\ fgY'ZcW'\ gYg'cb'>UdUbYgY'Wca\ a\ i\ b]WUf]cb']b'i\ ddYf'VY[\ ]bbYfg''Yj\ Y`'fh\fci\ [\ \ 'X]ZZYfYbh'hcd]Wg'fh\Uh$ 

 $\label{thm:cc_def} $$HY'W'' ifgY'' gYg''; Yb_j'' & Ug'U'hYI hVcc_"'HY'Zc``ck]b['') 'hcd]W'g'UfY'W''_j YfYX']b'hXY'`Ugh)' WXUdhYfg'cZhXY Vcc_"$ 

.

%"·····Dc`]hYbYgg`f\cbcf]Z\W]b`Zcfa U``Wca a i b]\WUh]cb\L

&"·····Dc`]hYbYgg'f\i a V`Y']b'Zcfa U`'Wca a i b]WUh]cbŁ

' "·····7 ca d`U]bhUbX bi ]gUbW

("....9Xi WUhcb

) "·····FYj ]Yk 'cZh\Y'hYfa 'UbX'Z hi fY'd`Ub

## 5ggYgga Ybh

## 5ggYgga Ybh'HUg\_g'

5ggYgga Ybh'hUg_	K Y][ \h	8i Y'8UHY	Gh XYbh@YUfb]b[ Ci hWca Yg 5ggYggYX
7 `Ugg'HYgltg'	' \$ı	Hi hcf]U``WUggʻ]b`K) 'UbX'cbY \ci f``YWi fY`]b`K - fBcj Ya VYf`%&Ł	% <u>Z</u> )
9l Ua '	')।	8if]b[ 'h\Y'Yl Ua 'dYf]cX	%ž&Ž Ž)
DfcYWhiDcfh7c`]c'	&\$ı	fYdcfh#c['hc'VY'dcghYX'cb AccX`Y'k]h\]b'hkc'XUmg'UZhYf YUVX'UWhjj]hm'	%ž(
7 ca deg]hjeb`UbX DfYgYbWhjeb`	%) ।	A i `hjd`Y`8i Y`XUhYg"'GYY 5XX]hjcbU``]bZcfa Uhjcb'VY`ck	%ž&Ž Ž)

## 5ggYgga Ybh'8YHJ]`g

5ggYgga Ybh'% '7`Ugg'HYghg

GhUfhXUhY. Bch5dd`]WUV`Y

@Yb[h\.'&\$'a]bihYg'dYf'hYgh

8YHJ]`g.

 $\label{thm:linear} $$Mci'k ]$``Wca d'YhY'hk c'ei ]nnYg'cZWU''' & $'a ]bi hYg'YUWX ž'Wca df]g]b[ 'U'Wca V]bUh]cb'cZX]$$WUh]cb'UbX $$$ 

H\]g`]g`U`&!\cifY! Ua ]bUh]cb`]b`h\Y`Zcfa U``Y! Ua ]bUh]cb`dYf]cX"`H\Y`Y! Ua ]bUh]cb`Wcbg]ghg`cZa i `h]d`Y W\c]WY`ei Ygh]cbg`UbX`g\cfh`hc``cb[`Ubgk Yf`ei Ygh]cbg"`Mci f`a Uf\_`k]```VY`Uj U]`UV`Y`cb`@A G`UbX`mci `WUb Wcbgi `hk]h\`h\Y``YWhi fYf`Zcf`Z fh\Yf`ZYYXVUW\_"`H\]g`]g`h\Y`ZbU``UggYgga YbhZcf`UhhYbXUbWY`di fdcgYg"

#### 5XX]h]cbU`'XYhU]`g.

Mci žcfimci fiZJa jima Ya VYfgža i ghibcha U\_YiUbmihfUj YiiUffUb[ Ya Ybhi bhjih\YiYl Ua ihja YhUViYi]g fYiYUgYX"

5ggYgga Ybh' . 'Dfc YWhDcfhZc`]c

Ghufh Xuhy.

8 YW] g.

#### 5XX]h]cbU`XYhU]`g.

7 \YW\_U'gYdUfUhY'XcW a YbhZcf'Z fh\Yf']bZcfa Uh]cb'cZYUW\'UWhj ]hm' A ccXY'fYdcfhgdUW'k]``VY'WcgYX'cb'Gi bXUmž'Bcj Ya VYf'&&'f( da Ł''

Gi Va ]gg]cb bch/g. Dcghh\Y``c[#Ydcfhfk]h\ 'Yj ]XYbWY ]ZfYei ]fYXL'cb A ccX`Y Zcf'U```UWfj ]h]Yg"

Hi fb]hjb gYhjb[. H\]g ]g bchU Hi fb]hjb Ugg][ ba Ybh

5ggYgga Ybh(. 7ca dcg]h]cb UbX DfYgYbhUh]cb

GHJfh:XUhY.

@Yb[h\.

 $\begin{tabular}{ll} Gi Va ] $gg]$cb"bchYg.$Hi fb]$h]b"]g"i gYX"Zcf"h\Y"Z]$fghXfUZhgi Va ] $gg]$cb"Zcf"mci f"WUgg"hi hcf""H\Y"ch\Yfgi Va ] $gg]$cbg"UfY"j ]U": cfi a "cb"A ccX"Y" \begin{tabular}{ll} \end{tabular} \label{tabular}$ 

 $\label{thm:condition} \mbox{Hi fb]h]b"gYh]b"[."H\]g"Ugg][ba Ybh]g"gi Va ]hhYX"h\fci [\Thi fb]h]b"UbX"ghi XYbhg"Xc"bchgYY"Hi fb]h]b g]a ]`Uf]hmfYdcfhg"$ 

## 5 hm/b XUb VW F Yei ]fYa Ybhg

 $\hbox{Ghi XYbhg'UfY'ghfcb[`mYbWci fU[YX'hc'UhhYbX'U```WUggYg'UbX'fYj]Yk ``YWhi fY'fYWcfX]b[g''] }$ 

## 7ci fgY'GWXYXi `Y

J]Yk 'WUgg'hja YhUV'Y

H]a YtUV`Y

8 UhY	HmdY	7 cbhYbh
K YY_'%''%('GYdhYa VYf'! % 'GYdhYa VYf	@YWi fY	@YWnifY'%'7cifgY'=bhfcXiWnjcb'UbX'7\UdhYf'%-fkck'hc'g\ck'dc`]hYbYgg']b'>UdUbYgY'%fi7i`hifYž
	<del></del>	

	K YY_').'%&'CWhcVYf'!'%* CWhcVYf	@YWhifY	@YWnifY:%:7\UdhYf:&%:fBi]gUbW:fi7i`hifYž; fUaaUfž:UbX:DfUWnjW: @YWnifY:&:7\UdhYf:&%:fBi]gUbW:fMcbhjbiYg:k]h\ FYUX]b[:UbX:Kf]hjb[:ZcW:g
		Hi hcf]U`	7`Ugg'h/ghfl/cjYfg'7\Udh/fg'%'UbX'&\$Ł HU`_]b['UVcihbi]gUbW'mci'\UjY'YIdYf]YbWX"
	K YY_'*.'%-'CWcVYf'!'&'	@YWh fY	Bc``YWfi fY`fh\]g`k YY_"
	C Whc VY f	Hi hcf]U`	Bc'h hcf]U`h\]g'k YY_"
		DfYgYbWhcb	DfYgYbrUrjcb XfUZnfWca dcg]rjcbEjg Xi Y Uh (da cb : f]XUmž C WcVYf & cb h fb]rjb"
	K YY_'+.'&*'CWcVYf'!''\$ CWcVYf	@YWn fY	@YWn fY'%'7\UdhYf'&%'fBi]gUbWYfi7i`hifYž; fUaaUfž'UbX'DfUWnW' @YWn fY'&'7\UdhYf'&&'f9XiWUnJcb'UbX'DUfYbhJb[fi; fUaaUf'UbX'DfUWnJWY
		Hi hcf]U`	HU`_]b[ 'UVci hff'][ ]cb'UbX'VY`]YZ]b'>UdUb
KAMAYANIYA	KYY_`, ``&BcjYaVYf'!`* BcjVadVyfdHVUnVUBXUdNUf	<b>@YWhifY</b> ¶ <b>&amp;</b> Ych7h¶dbih¶tojYg	@YWi fY'%'7\UdhYf'&&'f9Xi WUhjcb'UbX DUfYbhjb[fi7i'hi fYž'; fUa a Ufž'UbX'DfUWnJW Wcbhjbi Yg @YWi fY'&'7\UdhYf'&&'f9Xi WUhjcb'UbX'DUfYbhjb[fi Wcbhjbi Yg'k]h\FYUX]b['UbX'K f]hjb['ZcW'g
		Hi hcf]U`	DfUWNJWY fYei Yghjb[ k ]h\ WUi gUhjj Y j YfVg"
	K YY_''- 'Bcj Ya VYf'! % 'Bcj Ya VYf	@YWhifY	@YWn fY'%'7\UdhYf'&' 'fii h fY'D`Ubfi7i `h fYž ; fUa a Ufž'UbX'DfUWnW'WcbnJbi Yg @YWn fY'&'7'Ugg'HYghUbX'7\UdhYf'&' '7cbnJbi Yg

## FYgci fWfg

### DfYgWf]VYX F Ygci fWYg

• ; Yb\_] =

• ; Yb\_] = K cf\_Vcc\_

### FYWca a YbXYX FYgci fWfg

BchUj U]`UV`Y

### 7ci fgY 9j U`i Uh]cb UbX 8Yj Y`cda Ybh

cfa U`ZYYXVUW\_Zfca 'ghi XYbhg`k]``VY'Wc``YWhYX'j]U'a m'9|dYf]YbWYz'UbX'k]``VY'i gYX'hc']a dfcj Y'Z hi fY]hYfUh]cbg'cZh\]g'Wci fgY"'+bZcfa U``fYU`!h]a Y'ZYYXVUW\_]g'U'gc'j Yfmk Y`Wca Y'Y]h\Yf']b'dYfgcb'cf'h\fci [\'U A ccX'Y'Zcfi a 'Zcf'gi [[Ygh]cb'UbX'Wca a Ybhg"

### Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g

### Hi fb]h]b Gi Va ]gg]cb

Image: Ybwei bhyfu'dfcv'ya k \yb'uhhya dhjb[ 'hc'gi va ]hmci f'Ugg][ ba Ybhh\fci [ \ 'Hi fb]h]bz'd'YUgY

Hy'Yd\cby'9| hy'fbu''Gi ddcfhcb'-', ) '' ' ' %cf'Ya U]''h\Ya 'cb'Y! hy'fbu'hy'hgi ddcfh4 i bgk "YXi "Ui "''Gi ddcfh
\ci fg'UfY', .\$\$Ua '-'%\$.\$\$da 'cb'k YY\_XUmg'UbX'-.\$\$Ua '-').\$\$da 'cb'k YY\_YbXg'fl \*) 'XUmg'U'mYUft'''=Z'mci
UfY'i bUV'Y'hc'gi va ]hmci f'Ugg][ ba YbhXi Y'hc'U'ZJi 'hk ]h\ 'Hi fb]h]b'mci 'a Um'Udd'mZcf'Ub'Y! hy'bg]cbz'Vi hmci
a i ghfYhJ]b'mci f'h]W\_Yhbi a VYf'Zfca '9! hy'fbU''Gi ddcfhfU'cb[ 'k ]h\ 'Ubmch\Yf'fy'Yj UbhXcW a Ybhgthc
]bWi XY'Ug'Yj ]XYbW' hc'gi ddcfhmci f'Y! hy'bg]cb'Udd']WUh]cb"'=Zmci 'Ya U]''9! hy'fbU''Gi ddcfhmci 'k ]'`
Ui hca Uh]WJ'`mfYW']j Y'U'h]W\_Yhbi a VYfz'Vi hjZmci 'hy'Yd\cby'mci 'k ]``bYYX'hc'gdYW]Z]WJ'`mUg\_'Zcf'cby''
Hi fb]h]b'U'gc'dfcj ]XYg'i dXUhy'g'cb'h\Y]f'gmghYa 'ghUh' g'cb'Hk]hyf''

; YbYfU`mž'UggYgga YbhiHug\_g'a i ghVY'gi Va ]hhYX'Y`YVWfcb]\WJ``mij ]U'Y]h\Yf'Hi fb]h]b'cf'U'A ccX`Y Ugg][ ba Ybh''=b']bgHJb\W'g'k \YfY'h\]g']g'bchdcgg]V`Yž']hk ]```VY'gHJhYX'cb'mci f'\\circ i fgY'g'A ccX`Y'g]hY'k ]h\U`hYfbUh]j Y'gi Va ]gg]cb'XYHJ]`g"

cfi]bZcfa Uhjcbicbi\ckihcigi Va ]hUgg][ ba Ybhgicbi]bYij ]UiA ccXiY.i\hdg.#gh XYbhi bgk "YXi "Ui #\ck! gi Va ]hUgg][ ba Ybha ccXiY

## 5 WUXYa ]W<cbYghmUbX D`U[]Uf]ga

D`U[]Uf]ga i]gii g]b[ih\Yik cfXgicfi]XYUgicZch\YfgiUbXidfYgYbh]b[ih\Ya iUgimci fick b"i=hWJbihU\_Yia Ubm Zcfa gžZfca iXYi]VYfUhYiWXYUh]b[ihciUWW]XYbhU`mWcdm]b[iZfca iUigci fWYik]h\ci hiUW\_bck iYX[Ya Ybh'

IBGK [fcidg'd'U[]Uf]ga ]bhc'h\Y'Zc``ck]b['WUhY[cf]Yg.

- i bXYfgfUbX mci f'f][\hg'UbX'fYgdcbg]V]`]hJYg'Ug'U'gh XYbhUhl BGK
- VY`Uk UfY`cZd`U[]Uf]ga ž`Wcdmf][\hzil BGK `Gh XYbh7cXY`cZ7cbXi WhUbX`5VWWdhUv`Y`I gY`cZ I BGK `=\forall H`F Ygci f\W\g`Dc`]\wh
- VY 'Uk UfY 'cZh\Y 'ghUbXUfXg 'cZVY\Uj ]ci f'Yl dYWYX 'cZYj YfmcbY ']b 'h\Y 'l BGK 'Wca a i b]hm
- `cWUHY 'gYfj ]WYg'UbX ']bZcfa UH]cb'UVci hI BGK 'UbX'I BGK '@]VfUfm

Gca Y'cZh\YgY'UfYUg'k]``VY'ZJa]`]Uf'hc'mci ž'ch\Yfg'k]``VY'bYk"'; U]b]b['U'gc`]X'i bXYfgHJbX]b['cZU``h\YfY`UhYX'UgdYWng'cZ9@+69'k]``\Y`d'mci 'a U\_Y'h\Y'a cghicZmci f'ghi X]Yg'UhI BGK "'\\hd.##qi VYWfi |XYg"`]VfUfm'i bqk "YXi "Ui #\`]qY#JVci hY`]qY