

# **COMD5001**

±bhYfbUh]cbU`8YjY`cdaYbhDc`]Wm

HYfa "Hk c" ## "&\$%-

# 7ci fgY<sup>-</sup>Cj Yfj ]Yk

# <sup>'</sup>GhJZ'7cbhJWh'8YhJ]`g'

# 7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`]lm	@cWUh]cb	D\cbY
?f]g\bU'G\fYgh\U	_f]g\bU"g\fYgh\U4 i bgk "YXi "Ui		A cfj Yb 6fck bž ; fci bX: `ccfž F cca '; %+	- ' , ) %( %

#### "@YWhi fYfg"

B Ua Y	9a U]`	5j U]`UV]`] <b>m</b>	@cWUh]cb	D\cbY
>U[UbbUh\^5X\]_Uf]	"UX\]_Uf]4 i bgk "YXi "Ui	6mUddc]bha Ybh		

# GWXcc`7cbHJWhi±bZcfa Uhjcb

GWXcc``cZGcWJU``GWJYbWYg

Fcca '%) -

A cfj Yb 6fck b 7 &\$

Ya U]`. 'gcgg4 i bgk "YXi "Ui

d\cbY. '\$&'-',) '% \$+

# 7ci fgY 8YW] g

### 7 fYX]hDc]bhg\*\*

### Gi a a UfmcZh\Y 7ci fgY

### 7 ci fgY @YUfb]b[ Ci hWca Yg

- %" 9I d`U]b`\_YmWcbWfdrgžUddfcUWXYgž]ggi Yg`UbX`UWX]Yj Ya Ybhg`cZXYj Y`cda YbhhXYcf]Yg`Udd`]YX`Ug XYj Y`cda Ybhdc`]Wh]b`XYj Y`cd]b[ `Wci bhf]Yg
- &" 8 Yj Y`cd`U`Wf]h]WJ``dYfgdYWfj Y`cZXYj Y`cda Ybhdc`]WJYg`]a d`Ya YbhYX`hc`UXXfYgg`\_YmUgdYWfg`cZi bYj Yb`XYj Y`cda YbhžZcW g]b[`cb`a U'cf`]a d`]WUh]cbg`Zcf`h\Y``cWJ``Wca a i b]h]Yg
- ' "I bXYftU\_Y`Wf]t]WU``gcW]U``gW]YbWY`fYgYUfW\ž`]bXYdYbXYbhmUbX`]b`U`hYUa `Ybj ]fcba Ybhž'UbX XYj Y`cd`h\Y`\_bck `YX[ Y`UbX`Wca a i b]WUh]cb`g\_]``g`bYWYggUfmhc`Yb[ U[ Y`]b`]bhYfbUh]cbU` XYj Y`cda Ybhdc`]WmUbU`mg]g`UbX`dfUWf]WY

# HYUW ]b[ 'GhfUhY[ ]Yg'

H\]g`Wci fgY`]g`XYg][ bYX`fc`Vi ]`X`\_bck `YX[ Y`UbX`g\_]``g`]b`fY`Uf]cb`fc`XYj Y`cda YbhidfcV`Ya g`]b`XYj Y`cd]b[
Wci blf]YgzXYj Y`cda Ybhidc`]Whz`UbX`fk\Y`WcbgYei YbWrg`cZdc`]WhiUbX`dc`]WhifYzcfa "'H\Y`cV^YWf] Y`]g`fc
ZcWi g`cb`fk\Y`fUb[ Y`cZk Umg`k Y`WUb`]XYbh]ZmXYj Y`cda YbhiUg`Ub`]ggi Y`ffzfYl Ua d`Y`Ug`dcj Yffmcf
X]gUghYftz`]rg`Wca dcbYbhg`ffYWcbca ]WzgcWJU`z`W`fi fU`t`UbX`gc`i f]cbg`ffzfYl Ua d`Y`Ug`dfc[ fUa gz`dc`]WJYg
YhWt`fc`dfcV`Ya g`fk\Uh'UfY``cWU`z`bUfjcbU``UbX`[ `cVU``]b`Wk\UfUWfYf''\Nci `k ]```\Uj Y`fk\Y`cddcffi b]mifc`]bHYfdfYfz
UbU`mgY`UbX`dfcdcgY`gc`i f]cbg`fc`XYj Y`cda Ybhi]ggi Yg`i g]b[ `U`fUb[ Y`cZdf]bWJd`Yg`Wcbglfi WfYX`Ug`fk\Ycf]Yg
UVci hXYj Y`cda Ybhih\Uh'UfY`cZfYb`]b`WcbZ]Wkk]h\`YUWX`cfh\Yf`UbX``YUX`fc`U`fUb[ Y`cZ]bhYbXYX`UbX
i b]bHYbXYX`dfUWf]WU``ci HWca Yg''`H\Y`Wci fgY`k ]```YbWci fU[ Y`mci `fc`Yb[ U[ Y`]b``YUfb]b[ `fk\fci [ \`ghfi Wfi fYX
UWfj ]f]Ygz]bXYdYbXYbhWf]f]WU``fk\]b\_]b[ `UbX`fYgYUfWX!VUgYX`k cf\_"`5ggYgga Ybhg`k ]```Vi ]`X`\_bck `YX[ Y`UbX
g\_]``g`]b`U`fUb[ Y`cZXYj Y`cda Ybhidc`]Whifcd]Wg`UbX`UggYgg`Vcfk`k f]fhYb`UbX`cfU``dfYgYbfUf]cbg''

# 5ggYgga Ybh

FZ[e UagdeWZSe TWW adYS`[eWw i [fZ S\_ [j aXXSUWfa XSUWeW\_ [`Sdeła` f` W dWSV[`Y SUffh[ff[We S`V S`; fW e[hW6Sk ahWdS i WW] W Vž; FWd\_ \$ fZ[e; fW e[hW6Sk i [^a` ESfgdVSk \$" <g /kł Xda\_ + z%" S\_ fa &z%" b\_ [`? adhW 4dai` 9 (z B WSeWeWWfZW? aaV WUagdeWbSYWXad\_ adWVWfS[^ez\*

<u>**abhYbg]j Y**8Um</u> ``&\$`>i `mGUhi fXUmfl "' \$Ua 'hc ("' \$da Ł

8]gUghYfg UbX 8Yj Y`cda Ybh']b h\Y < ]a U`UmUg

K Y'YI Ua ]bY'\_Ym]ggi Yg'cZX]gUgHYfg'UbX
XYj Y`cda YbhfY`Yj UbhZcf'h\Y'Wci fgY"'H\Y']bHYbg]j Y
XUm]g'X]j ]XYX']bhc gYj YfU`'dUffg"'+b'h\Y'Z[fghUbX
gYWcbX'dUffgzk Y'k]```\Uj Y'gYa ]bUfg'Wcj Yf]b[
X]gUgHYf'WcbHYI hz'UbX'X]gUgHYf'WJgY'ghi Xm]b'BYdU`
< ]a U'UmU"'6ch\ gYa ]bUfg'k]``\Uj Y'gYa ]bUf'UbX
X]gW gg]cb'gYgg]cbg"'H\Y'h\]fX'dUfficZh\Y'XUmk]``
]bj c'j Y'U'dc`]WhUbU`mg]g'#XY']VYfUh]cb'fc`Y!
d`Um''A cfY'XYHJ]`YX'ci h`]bY'cZh\Y'+bHYbg]j Y'8Um-']hg
gHi Wi fYz'fYei ]fYX'dfY!fYUX]b[ gz'UbX'dfYdUfUh]cb'k]``VY'dfcj ]XYX']b'WUgg"

### 5ggYgga Ybh'HUg\_g'

5ggYgga Ybh'tUg_	K Y][\h	8iY'8UHY	Gh XYbh@YUfb]b[ Ci hWca Ygʻ5ggYggYX
Dc`]Wm7 UgY Ghi Xm	) \$1	\$-#\$, #&\$%-`%%) - `DA	%ž&Ž
C fU``DfYgYblUljcb`	&\$I	Bch5dd`]WUV`Y	%ž&
DUdYf'Wf]h]ei Y'	' \$ı	\$) #\$+#&\$%- '%%) - 'DA	%ž&Ž

# 5ggYgga Ybh'8YhJ]`g

5ggYgga Ybh% Dc`]Wm7UgY Gh Xm

GhUfhXUhY. Bch5dd`]WUV`Y

@Yb[h\. %\$\$\$ k cfXq

8 YW] g.

 $DfYgYbfUh]cb. `HmdYk f]hhYb'k ]h\ ``]bY `gdUW]b[ `cZ%'') \\ \check{z} \& `dc]bhZcbhig]nY `UbX`a Uf[ ]bg `bc ``Ygg'h\ Ub' & `Wa \check{z} Wcbg]ghYbhZcfa Uh]b[ `UbX'fYZYfYbW]b[ `ghmY'' `$ 

H\Y`WUgY`ghi XmfYdcfhidfcj ]XYg`mci `k ]h\`h\Y`cddcfhi b]hmhc`]bj Ygh][ UhY`]b`gca Y`XYdh\`U`gdYVJZ]W XYj Y`cda Ybhidc`]Wm]ggi Y`UbX`dfcXi WY`U`fYgYUfW.!VUgYX`XcW a Ybh'\Mci `\Uj Y`hc`W\ccgY`U`dc`]Wm\WJgY Zfca `U`XYj Y`cd]b[ `Wci bhfmh\UhXYa cbghfUhYg`j Uf]ci g`UgdYWg`cZgVJYbWY`UbX`dc`]hJWg`]b`dc`]Wm XYj Y`cda YbhUbX`]a d`Ya YbhUh]cb"`Mci `WJb`W\ccgY`UbmWcbhYa dcfUfmXYj Y`cda Ybhdc`]Wm]ggi Yg`—`gi W\Ug.

UŁYei ]mi]b XYj Y`cda Ybhi

VŁX]gUgHYffYWcj Yfmdc`]Wm]b BYdU`fcfUbmXYj Y`cd]b[ Wci blfmŁ

W£fYgdcbX]b[ 'hc'i fVUb'dcj Yfmi]b' ±bX]U'fUbma ]XX'Y!]bWca Y'Wci blfmŁ

D Y U G Y 'b c h Y 'h U h h Y G Y 'U f Y 'h g h ] b X ] W U h J Y 'h c d ] W G U b X 'm c i 'U f Y 'Z f Y Y 'h c 'W c c g Y 'm c i f 'c k b 'h c d ] W U b X 'W U g Y 'U g 'r c b [ 'U g 'm c i 'W b 'U f h Y 'g W ] Y b W Y ! d c `] W h i ] b h Y f Z J W 'Y b g '] b 'h Y 'W U g Y # c d ] W c Z m c i f 'W x c ] W '' ''

&"'H\Y'[YbYfU``WcbhYI hcZh\Y'fY[]cb'UbX'h\Y'h\Ya Y'cZmci f'W\c]\W'!'dfcj]XY'[YbYfU``WcbhYI hi U`]bZcfa Uh]cbz'hYbXgz']ggi Yg'fY`Uh'X'hc'h\Y'h\Ya Y'UbX'fY[]cbg'UbX'h\Y'bUhi fY'cZgi ghU]bUV'Y'XYj Y`cda Ybh W\U``Yb[Y'fh (\$\$`k cfXgŁ

""H\Y'dc`]WmdfcV`Yag`UbX'h\Y'dc`]WmdfcW\gg`!'aUd`cihUWcfgž`dc`]WfYgž'd`Ubgž`]bWiX]b['h\Y]f`\]ghcf]Ygž\ck`Zcfai`UhYXž\_Ym\][\`][\hg`cZh\Y'd`Ubg#dc`]WfYg'UbX'dfYgYbhgWfYbW\!dc`]WmXmbUa]Wg`fh,\$\$`kcfXgŁ"H\Y'igY`cZfY`YjUbhXUhU'hUv`Ygž'Z[ifYgžaUdg`UbX'ch\Yf'Yj]XYbW\'UfY`\Y`dZ\`"

("'Dc`]Whici HVca Yg'UbX'UbU`mq]g'cZ]a dfcj Ya Ybhicddcfhi b]hYg']b'h\Y'Yb\UbW]b[!gW]YbWY!dc`]Whi]bHYfZJWYž

GhUfhXUhY. Bch5dd`]WUV`Y

@Yb[h.:5ddfcl":%\$dckYfdc]bhg`[XYq/" \$\$k cfXg'gi a a UfmUbX'dUfh]WdUh]cb

8 YHJ]`g. 'DfYgYbHJhjcb'cZUddfcl ]a UHY`m'%\$'g`]XYg'Z ``mfYZYfYbWYX/Ghi XYbhg'k ]```fYWY]j Y'k f]HYb'ZYYXVUW\_UbX'U'a Uf\_YX'fi Vf]Wk ]h\]b'hYb'XUmg'cZh\Y]f'dfYgYbHJhjcb"'H\Y'fi Vf]Wk ]```VY'Uj U]`UV'Y'UhH\Y'gHJfhcZ gYa YgHYf'nc'U``ck 'ghi XYbhg'nc'k cf\_'nck UfXg'WYUf'mWca a i b]WJHYX'gHJbXUfXg"'''

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

UŁDfYgYbhUhcb fA Uf\_! % Ł

- % Dck YfDc]bhg`]XYg`fUddfcl "Łždi fdcfhYX`mfYZYfYbWX`UbX`]bhfcXi WYX`
- Mci k]```[]j Y'U'dfYgYbhUh]cb'cZUVci h'%\$'a]bi hYgžgi a a Uf]g]b['h\Y'\_Ym]XYUgž]ggi Yg'UbX ei Ygh]cbg'VUgYX'cb'h\Y'fYUX]b[g'flVch\'dfYgWf]VYX'UbX'ch\YfgŁ''Nci 'g\ci 'X'XYV]XY'ghfUhY[]Yg'— Y"["'\ck 'hc'Wca a i b]WUhY'mci f'a YggU[Y'YZZYWf]j Y`mž\ck 'UfY'mci '[c]b['hc'fYgdcbX'hc'ei Ygh]cbgž UbX'\ck 'mci 'UfY'[c]b['hc'Yb[U[Y'h\Y'fYghcZh\Y'WUgg'UZhYf'h\Y'dfYgYbhUh]cb'YhW'
- H\Y`df]a UfmU]a `cZh\]g`dfYgYbhUh]cb`]g`hc`\][\`][\h\_Ym]ggi Yg`cZfY`Yj UbWY`hc`h\Y`Wti fgY`gc`Ug`hc \bqd]fY`UbX`]bZta `mci f`Wt``YU[i Yqž'UbX`U`qc`hc`fYZYWimci f`ck b`fYqYUfW\`UbX`]bHYfYghg"'±na i gh

#### 5 hmy b X Ub WY F Yei ] f Ya Yb hg

Ghi XYbhgʻUfYʻYl dYWYXʻhcʻdUffjVJdUhYʻUWJj Y`mʻ]bʻU```YUfb]b[ʻUbXʻhYUW\]b[ʻUWJj ]hJYgʻf\YbWʻZcfh\ʻ'WUggYgʻž hcʻ]bWi XYʻ`YWi fYgʻzhi hcf]UʻgʻzgYa ]bUfgʻzʻ`UVgʻzcb`]bYʻUWJj ]hJYgʻUbXʻgcʻcb½"-Zmci ʻUhfYbXʻYggʻh\Ubʻ, \$i cZ WUggYgʻzmci ʻa UmVYʻfYZ gYXʻZ]bU``UggYgga YbhʻNci ʻUfYʻfYgdcbg]V`YʻZcfʻ\_YYd]b[ʻhfUW\_cZmci fʻUhfYbXUbWW UbXʻWcbhUWJb[ʻmci fʻWci fgYʻWcbj Ybcfʻ]a a YX]UhY`m]Zmci ʻUfYʻWcbWYfbYXʻUVci hmci fʻUhfYbXUbWWʻfYWcfX UbXʻ]mgʻ]a dUWhcbʻmci fʻUV]`]hmhcʻWca d`YhYʻmci fʻWci fgYʻgi WWggZi``mʻ: cfʻh\Yʻdi fdcgYʻcZUhfYbXUbWWʻa cb]hcf]b[ʻz'h\YʻZ]bU``UggYgga Ybh'Zcfʻh\]gʻWci fgYʻ]gʻDc`]Wmi7 UgYʻGhi Xmk cfh\)\$, cZmci fʻcj YfU```[fUXYʻZcfh\]gʻWci fgY']h\YggYgga Ybh'JhYaʻh\Uha UmVYʻ[fUXYX'UhnYfcʻ]Zmci ʻXcʻbcha YYhh\YʻUhfYbXUbWWʻfYei ]fYa Ybh'Zcfʻh\]gʻWci fgY''

# 7ci fgY GWX YXi `Y

#### J]Yk 'WUgg'ha YHUV'Y

#### H]a YHJV`Y

8UhY	HmdY	7 c b h Y b h
K YY_"%" ">i bY"!"+">i bY	GYa]bUf	)
		7`Ugg'%'7cifgY']bhfcXiWh]cb
		<pre>-blfcXi Whjcbihcih\YiWci fgYiUbXi\ck i]hi]gicf[ Ub]gYX/ ]blfcXi WhjcbihciWUggidUfhjWldUbhg/]XYbhjZjWUhjcbicZ _Ym]ggi Ygik \]W\ik Yik ]``YI d`cfYiYhWiiCVYWhjj Yg UfY.i</pre>
		! '7 `Uf]ZmYl dYWHJcbg'Ufci bX'h\Y'Wci fgY
		! @YUfb UVci hYUWX ch\Yf/]XYbh]ZmWcbhf]Vi h]cbg UbX Yl dYWUh]cbg
		! '8Yj Y`cd'[fci dg'Zcf']bhYbg]j Y'WUggYg
K YY_^&.^%\$^>i bY^!^%( >i bY	GYa ]bUf	%&`>i bY`&\$%-`
21.01		7`Uggʻ&ʻDYfgdYW¶j Ygʻcbʻ≢bhYfbUh]cbUʻ 8Yj Y`cda Ybh'Dc`]Wm
		? YmfYUX]b[ g'UbX']b]hJU``dfYgYbhUhJcb'—'k \UhXc'k Y a YUb`Vm]bhYfbUhJcbU``XYj Y`cda YbhYk \UhXc'k Y a YUb`Vm]bhYfbUhJcbU``XYj Y`cda Ybhdc`]Wh3'K \Uh UfY'h\Y'Wf]hJWU``dYfgdYWhJj Yg'UbX'a U'cf']ggi Yg3
K YY_'' .'%+'>i bY'!'&% >i bY	GYa]bUf	% '>i bY '&\$%-
N 10 1		7`Uggʻ'∵Di V`]WDc`]WmUbXʻ±bhYfbUh]cbU` XYj Y`cda Ybh
		K Y`YI d`cfY`]ggi Yg`fY`UhYX`hc`di V`]Wdc`]WniUbX ]bhYfbUh]cbU``XYj Y`cda Ybh'ʻ ŧbʻdUfh]W``Ufžk Y`ZcW gʻck h\Y`dfcWfggYgʻUbX`UWcfg`]bj c`j YX`]b`]bhYfbUh]cbU`

	XYj Y`cda Ybhdc`]\\f\'
	Bchy. Ghi XYbh; fci dgʻk]``VyʻZbUʻ]gyXʻZcfʻh\yʻ]bhybg]j yʻXUhʻl; fci dgʻk]``fydfygybh_ymghU_y\c`Xyfgʻ]bj c`j yXʻ]b ]bhyfbUhjcbU``Xyj yʻcda Ybhgi W\`UgʻUŁ']bhyfbUhjcbU` UbX``cWJ``B; CgžVŁ'bUhjcbU``UbX``cWJ``[cj Yfba Ybhg/ WŁ`cWJ``Wca a i b]hjyg/XŁ'V]`UhyfU``XcbcfgʻUbX ]bhyfbUhjcbU``ZbUbWjU``]bghjhi hjcbgž'UbX`YŁ'XYj y`cda Ybh gW\c`Ufg"'`Ghi XYbhgʻk]``VY`UV`Y`hc`XYa cbghfUhY`Ub i bXYfghUbX]b[`cZh\Y`dc`]hjWJ``YWcbca mUbX`h\Y`fUb[Y cZ]bZi YbWygʻcb`UWhcfgʻk cf_]b[`cb`]bhyfbUhjcbU` XYj Y`cda Ybhdc`]Whf''
FYUX]b[	&* '>i bY ! 'BC '7 @5GG.' A` ^ WSUf[h[fk i WW] f]b``]Yi 'cZ <b>7`Ugg</b> '(Ł
	3 xfwd Ua_ b wf[`Y kagd dw\$V[`Y S^aUSfwW xad fZ [e i ww] /S _ [` [_ g_ a X fi a S df[U we fi w\$ uZ e fg V w fi [^ i df w S %" " i a dve e g S dx S`V e g T_ [f f Z [e e g S dx fa _ f]g \ b U "g \ f Y g f \ U 4 i b g k "Y X i "U i T k # # \ Z + b _ ł \$* < g` \ w @ a e g T _ [e e [a` a d \ S f w e g T _ [e e [a` i [ \ dwe g f [` k a g T w] Y S T e w f X a d f Z [e e w _ [` S d
Cb`]bY'5Wfj]hm	
	F YUX]b[

		.' '-'B; Cg']b'8]gUghYf'a UbU[Ya Ybh
K YY_'%\$.') '5i [i gh!'- 5i [i gh	DfYgYblUl]cb	_ ( '-': cfY][ b'U]X'UbX'XYj Y`cda Ybh +'5i [ '&\$%
		CfU``dfYgYbhJh]cb`'
		Hcd]Wg^hc^VY^dfYgYbhYX^!
		.)-": ccX"gYWf]mm]ggi Yg"UbX"WXU``Yb[Yg
		. *-'G`i a g'XYj Y`cda Ybh]b'i fVUb]g]b[ '5g]U
		B 'ge XWWTSU] S`V WhS 'gSf[a`
		EZSdWdWXWUf[a`ea`fZWUagdeWi[fZS`W_bZSe[ea`a`a`W[_badfS`f'WSd'[`Ył Weea`ł Ua`UWbfade][^z7SUZbSdf[U[bS`fi[^TWWj'bWUfW fa Ua`fq[TgfW[e[YZfeS`VUd[f[cgWSdag`ViZSffZWkZShWUZaeWS`ViZkž

# F Ygci fWyg

### DfYgWf]VYX F Ygci fWYg

A UbmfYgci fWgʻUfYʻdfcj ]XYX`k ]h\]bʻh\Y`A ccX`Y`g]hYʻZcfʻh\Y`Wci fgY"`D`YUgY``cc\_ʻfY[i`Uf`mUhih\Y`a UhYf]U`g Uj U]`UV`Y`Zcf`YUW\`k YY\_ž'Ug`k Y```Ugʻh\Y`UXX]h]cbU``fYgci fWgʻi d`cUXYX"`H\YfY`]gʻU`k UmgʻU`A ccX`Y`Zcfi a Zcf`X]gW gg]b[`k\Uhimci `\Uj Y`fYUX`UbX``YUfbYX"`I gY`h\]gž`g\UfY`mci f`]bg][\hgž`]bj ]hY`ZYYXVUW\_`"""`h\Uhfg \ck`mci `k]```YUfb°

#### FYWca a YbXYX FYgci fWyg

 $H\Y''hYI''hg''UbX''fYUX]b[g''UfY'cZYfYX''Ug']b]h]U``VUW_[fcibX''fYUX]b["'H\Y'mdfcj]XY''Ub']bhfcXi Wh]cb'hc'h\Y'_Ym \\ ]ggi Yg'cb'k \]```ZcW g'Vi h'UfY'bchhc'VY'Wcbg]XYfYX'Wca d'YhY'cf'Wca dfY\Ybg]j Y"''<math>\pm$ i]g'cif YI dYWhUh]cb'h\Uh'Wci fgY'dUfh]W]dUbhg'k ]```YI d`cfY'h\Y']ggi Yg'Vmi bXYfhU\_]b['h\Y]f'ck b'fYgYUfW\'UbX fYUX]b['UbX'h\Uh'\Ymk]``Vf]b['h\YgY']bhc'h\Y'WUgg'X]gW' gg]cbgžXYVUhYg'UbX'Ugg][ ba Ybhg''

<cddYf'D"''f&\$%&L"'| bXYfqlUbX]b['8YjY`cdaYbh'''7UaVf]X[Yž'Dc`]m"</pre>

? ]b[ gVi fmž 8 "ž A UW\_Umž > "ž < i bhž > "ž A W ]``]j fUmž A `UbX 7 `Uf\_ž A "ž f&\$\$, Ł" +bhYfbUh]cbU``8 Yj Y`cda Ybh +ggi Yg`UbX 7 \U``Yb[ Ygž DU`[ fUj Y A UWa ]``Ubž < ci bXa ]``g"

@YUWXž'A "'UbX'="GWccbg'f&\$\$) L"'GW]YbW''UbX'7]h]nYbg.'; `cVU`]nUh]cb'UbX'h\Y'7\U``Yb[Y'cZ9b[U[Ya Ybhž NYX'6cc\_qž'@cbXcb"

A cggYž8"'f&\$\$) Ł"'7i `hjj Uhjb[ '8Yj Y`cda Ybh'5b'9h\bc[ fUd\mcZ5]X'Dc`]WhiUbX'DfUWf)WY"'BYk '8Y`\]ž J ]ghUUf'Di V`]WUhjcbg"

FcVV]bgžD"'f&\$%&t"''Dc`]hJWU`'9Wc`c[m'5'7f]hJWU`'+blfcXiWf]cb'f&bX'9X]hJcbt"'6`UW\_kY``"

GYbž'5"'f% - - Ł"'8Yj Y`cda YbhUg': fYYXca ž'C l ZcfX'l b]j Yfg]lmDfYgg"

G\fYgh\Už?""?"'f&\$%\*\tž8]'Ya a Ug`cZ>i gh]WY.'7c``YWn]jY'UWn]cb'UbX'9ei ]hmi]b'BYdU''g'7ca a i b]hm : cfYghfmž'5Xfc]hDiV`]g\Yfgž'BYk'8Y`\]ž\=bX]U"

 $\label{eq:continuity} $$H\ca Ug^5\check{z}A\ c\Ub^; "``f&$$+\xi"``F YgYUfW\`g_]``g`Zcf`Dc`]WmUbX`8 Yj Y`cda Ybh''`< ck 'hc'Z\bX'ci hZUghž @cbXcbž`GU[Y"$ 

 $K\ cfX'7\ ca\ a\ ]gg]cb'cb'9bj\ ]fcba\ YbhUbX'8\ Yj\ Y`cda\ Ybhfl/\label{eq:cfX'} YbhIbX'8\ Yj\ Y`cda\ Ybhfl/\label{eq:cfX'} YbhIbX'8\ Yj\ Y`cda\ Ybhfl/\label{eq:cfX'} YbhIbX'8\ Yj\ Y`cda\ Ybhfl/\label{eq:cfX'} Yca\ a\ cb':\ i\ h\ fYžCl\ ZcfX'l\ b\ ]j\ Yfg]hm\ DfYggžCl\ ZcfX''$ 

.

#### 5fh|WYg h\ Uhmci a UmZ|bX cZ]bhYfYgh

5 [ fUk U`ž5"'UbX'; ]Vgcbž7"'f‰ -- Łž9bW.Ubha Ybh'UbX'8]gYbW.Ubha Ybh'H\Y'F c`Y'cZ7 ca a i b]hm]b B Uhi fU`F Yqci fW'7 cbqYfj UhicbžK cfX'8Yj Y`cda Ybh'&+'f('L'\*&-!\*('-"

5 fbgh/]bž'G"'f%-\*-Łž'5``UXXYf'cZWjhjnYb'dUfhjWjdUhjcbž'>ci fbU``cZ5a YfjWUb' ⊕ghjhi hY'cZD`Ubb]b['') 'f(Ł&%\*!&&("

 $6 \ UfX \ Ubz`D"`f&\$\$\&t"```8 \ YW'blfU`]nUl]cb'cZ[cj \ YfbUbW'`UbX'XYj \ Y`cda \ Ybl''``H\Y'>ci \ fbU``cZ9 \ Wcbca \ ]W \ DYfgdYW]j \ Yg''*f( \ t '% ) ! \&\$) "$ 

6YVV]b[ hcbž5"'f%---ŁžGcW]U``WJd]hU`žXYj Y`cda Ybhž'UbX'UWWgg'hc'fYgci fWg']b'\][\`UbX'9W'UXcfž9Wcbca]W; Yc[fUd\mi+)'f(Ł''-)!(%"

6ck Yb 'GžNk ] '5 " 'f&\$\$) Ł'DUh\ k Umg 'hc 'Yj ]XYbWY!]bZcfa YX 'dc `]WniUbX 'dfUW]WY. 'U 'ZFUa Yk cf\_ 'Zcf UW]cb " 'Di V`]W@|VfUfmcZGW|YbW/Z'A YX]WbYZ'&\$\$) '& 'f|+Ł/\$%\$\$!\$%\$\* 'f|Y%\* \* Ł" ''

6fYhrž'9"'f&\$\$' Ł'DUfhJWJdUhJcb'UbX'UWVci bhUV]`]hmi]b'XYj Y`cda Ybha UbU[ Ya Ybhz'>ci fbU``cZ8Yj Y`cda Ybh Gh X]Yg'(\$'f&L'%\&-"

7\\UlfYž5"'UbX'J "'GUVYfk U``f&\$\$\*E"'"8Ya cWfUWhž8Yj Y`cda YbhUbX'fF Y!E'J ]g]cbg'cZBUh fY. 'F i fU` 7 cbZ]\Wg`|b'h\Y'K YghYfb'< ]a U`UmUg"''>ci fbU``cZDYUgUbhGh X]Yg'' ' f('E'\*+, !+\$\*"

7 cfbk U``ž5"'f&\$\$, Ł'I bdUW\_]b[ ''DUff]W]dUl]cb'. 'a cXY`gža YUb]b[ g'UbX'dfUW]WYg'ž7 ca a i b]lm 8 Yj Y`cda Ybh'>ci fbU``(' .' &\* -! &, ' "

< UfX]bž; "'f%-\*, ŁžH\Y'HfU[YXmcZh\Y'7 ca a cbgžGV]YbW'%\* & '%('!%(, "

? UhYgžF "žDUff]gžH" UbX @Y]gYfck ]mž5 " f&\$\$) ŁžK \Uhi]g gi ghU]bUV Y XYj Y`cda Ybhž9bj ]fcba Ybh(+ fl Ł - !&%"

@ bXž7"`f&\$\$\*\!"`"Hk ]`][\hi=bgh]hi h]cbg.`Di V`]W5i h\cf]hm'UbX`@c\W\``Dc`]h]\Wg\""`8Yj Y`cda Ybh'UbX`7\Ub[Y '+f(\text{L'\*,})!+\$)"

 $A cggY\~z 8 "f\&\$\% \ \&" H\Y`Ubh\fcdc`c[mcZ]bhYfbUh]cbU``XYj Y`cda Ybh'`5bbi U``F Yj ]Yk `cZ5bh\fcdc`c[m''(\&\&\$+!\&(*"$ 

 $C \land U \breve{z} < "`f \& \$\% \ \& "``7 \ ci \ bh f U who [` \land Y [ Ya \ cb] W d ck \ Yfg'] b `h \land Y `d c`] whidf c w gg. ``wf] h] w U `` U who b `f Yg Y U f w `cb B Y d U `'g' \% f L `& ( &! & * &"` \$ 

 $DYUfgcb`A\ \check{z}Nk\ ]`56\check{z}6i\ W\_YmB5"`DfcgdYWfj\ Y`Dc`]Wm5bU`mg]g.`<ck`Ub`Yd]gfYa\ ]WWca\ a\ i\ b]fmi]bZcfa\ YXdc`]Wma\ U_]b[\ cb`]bfYbf]cbU``gY`Zdc]gcb]b[\ ]b`Gf]`@Ub_U"`<YU`fN\ F YgYUfVX`Dc`]WmUbX`GmgfYa\ g`&$\%$\check{z},.%/$ 

GbYXXcbž7"ž<ck Uff\\ žF"'UbX'Bcf[UUfXžF"'f&\$\$\*\\ ŁZGi ghU]bUV`Y'XYj Y`cda Ybh]b'U'dcgh6fi bXhUbX k cfXZ'9\\ c[]\\ W\)'\ -&\*, "

K YggY`]b\_ž5"ž?"'G"'6i W.UbUbž'M''; Ycf[]UXci 'UbX'9"'Hi fb\ci hf&\$%' &\"'"HYW.b]WU`\_bck `YX[Yž X]gW fg]j Y`gdUWYg`UbX'dc`]hWg`Uh'h\Y`gWJYbWY!dc`]Wni]bhYfZUWY""'9bj ]fcba YbHU``GWJYbWY'' 'Dc`]Wni' \$.`%!-"

Nk] 56ž6`][ bUi `h'≢'6i bXY!6]fci ghY 5žF]hW\]Y '>žG]`cj Y '8" '`8YV\]g]cb!a U\_YfgžXcbcfg`UbX`XUhU. 'ZUWrcfg]bZi YbV\]b[ 'h\Y`XYj Y`cda YbhcZa YbhU``\YU`h\`UbX'dgmW\cgcV]U``dc`]Wh]b 'h\Y`Gc`ca cb'-g`UbXg" ''< YU`h\ Dc`]WmUbX`D`Ubb]b[ ž

&\$%%/&\* f('L'', !'(, "Xc]."%\$"%\$-'#\YUdc`#Me\$\*-"...

\hd:#\YUdc`"c|ZcfX'cifbU`g"cf[#\cbhYbhYUf\m\&\\$\#\\YUdc`"\\he\\$\* - "Z\``

5 XX]h]cbU``gci fWgʻZcfʻfY`Yj Ubha UhYf]U``]bWi XYʻh\Y`XU]`mdfYggžʻh\Y`di V`]WUh]cbgʻcZXYj Y`cda Ybhcf]YbhYX cf[ Ub]gUh]cbgžgi W\`UgʻB; CgʻUbXʻh\cgY`h\Uha cb]hcfʻh\Ya "'8 Yj Y`cd]b[ `Wci bhfm[ cj Yfba Ybhdi V`]WUh]cbg UbXʻh\cgY`cZh\Y`K cf`X`6Ub\_'UfY`i gYZ\``gci fWyg"·5 XX]h]cbU``fYUX]b[ gʻk ]```VY`dfcj ]XYX`cf`fYWca a YbXYX cb`U`k YY\_`mVUg]g`UbX`k ]```VY`]XYbh]Z]YX`]b`h\Y`cb`]bY`g]hY`UggcW]UhYX`k ]h\`ci f`Wci fgY"

: i fh\Yf'UXj ]WY cb fYUX]b[ g UbX ]VfUfmfYgci fWyg.

H\Y`@|VfUfmik YVg||Y`|g`Uh<u>\hd.#|bZc"`|VfUfm'i bqk "YXi\_"Ui #k YV#qYfi |WYq#qYfi</u> |WYq"\ha`

7 ci fgYg'UfY'Uj U]'UV'Y']b'h\Y'@]VfUfmiZcf'`YUfb]b['\ck 'hc'i gY'Y`YWfcb]WfYgci fWYg'!'=j Yfmighfcb[`m fYWca a YbX'mci i gY'h\Ya "'

Mci 'k ]``'VYbYZ]hZfca 'VYWca ]b[ 'ZJa ]`]Uf'k ]h\; cc[ `Y'GW\c`Uf'f\hd.#gV\c`Uf'[cc[ `Y'Wca \text{L'Ug'U'\_YmgYUfW\c'} Yb[]bY'Zcf'UWUXYa ]Wdi V`]\WJh]cbg'UbX'fYdcfhg"'\Mci 'WJb'gYhi d'h\Y'dfYZYfYbWYg'hc'`]b\_'hc'h\Y'I BGK
@]\VfUfmYj Yb'k \Yb'mci 'UfY'bch'cb'\WJa di g"'

; c'hc';  $cc['Y'GWkc'Uf2'gYhf]b[g2'']VfUfm'']b_gž'UbX'YbhYf''I b]j Yfg]lmicZBYk 'Gci h\ 'K U'Yg'']b'h\Y'VcI 'Zcf''@]VfUfm''.$ 

H\Y'@\VfUfmU`gc`\Ug`U\W\granghc`Y`Y\\fcb]\W\cd]Yg`cZa Ubmi[YbYfU``XYjY`cda Ybhi'ci fbU`g`h\UhUfY`i d`hc XUhY`UbX`\UjY`YI \W```Ybh`gdY\\JU``]ggi Yg`cb`a UbmcZh\Y`hcd]\\g`kY`\\cd]Yf'`K]h\]b`A ccX`YžkY`k]```VY XfUk]b[`mci f`UhYbh]cb`hc`ch\Yf`'ci fbU`g`UbX`\cdY`mci k]```]bZcfa YU\\`ch\Yf`cZjU`i UV`Y`fYgci f\\g''`

KYk]``UXX'hc'h\Y``]ghcZi gYZi ``^ci fbU`g`hc'a cb]hcfžVi hih\YgY'UfY'U'[ccX'ghUfh'

5q]U'DUWZWJ]Yk dc]bh

8Yj Y`cda Ybh

8Yj Y`cda YbhUbX'7\Ub[Y

9bj ]fcba Ybhž8Yj Y`cda YbhUbX'Gi ghU]bUV]`]hm

; YbXYf'UbX'8YjY'cda Ybh

; `cVU`'9bj ]fcba YbHJ`'7\Ub[Y

>ci fbU``cZ +bhYfbUhJcbU``8Yj Y`cda Ybh

>ci fbU`cZ8Yj Y`cda YbhGh X]Yg

>ci fbU`cZ8YjY`cda YbhDc`]WhiUbX`DfUWfWY`

>ci fbU`cZ@Uhjb 5a Yf]WUb Gh X]Yg

>ci fbU`cZ8Yj Y`cd]b[ '5fYUg

Di V`]W5Xa ]b]ghfUh]cb UbX 8Yj Y`cda Ybh

FYj ]Yk 'cZ5Zf]WUb'Dc`]f|WU`'9Wcbca mH\Ycfmž7i `hi fY'UbX'GcW|Yhm

Gi ghJ]bUV`Y 8 Yj Y`cda Ybh

K cfX'8YjY'cda Ybh

; YcZcfi a

FY[i`Uf`fYdcftg`fgYY`kYVg]tYg`tc`[Yhit\Y``UtYgtz`]bWiXY.

I b]hYX'B Uh]cbg'8Yj Y`cda YbhDfc[fUa 'UbX'Ubbi U``<i a Ub'8Yj Y`cda YbhF Ydcfhy' $\pm$ bhYfbUh]cbU``@UVci f C f[ Ub]gUh]cb'f\elleC \ell I B 9 G 7 C 'F Ydcfhg/K cf'X'6Ub\_'UbX' $\pm$ A : 'F Ydcfhg/5g]Ub'8Yj Y`cda Ybh6Hb\_/C 9 7 8 F Ydcfhg'fBYj Y`cda YbhGhi X]Yg'7 YbhY\ell/K cf'X'HfUXY'C f[ Ub]gUh]cb'fK HC \ell/K cf'X'<YU'h\'C f[ Ub]nUh]cb fK < C \ell-UbX'a Ubma cfY''

GYY'U`gc'h\Y'k YVg]hYg'Zcf'XYj Y`cda Ybh']bZcfa Uh]cb'\i V'cf[Ub]nUh]cbg'gi W\'Ug.

8Yj Y`cda Ybh; UhYk Um'Uh\hd.#k k k "XYj Y`cda Ybh UhYk Um'cf[#

K \m8Yj 'Uhi\hd.#k k k'k \mXYj "cf[ - 'h\]g']g'U'bYk cf\_'gYhi d'Vm8Yj Y`cda YbhGhi X]Yg'[ fUXi UhYg'Zfca I BGK 'UbX'gYY\_g'hc'g\UfY'fYgci fWrg'UbX'gi ddcfhih.cgY'YbhYf]b[ 'UbX'YghUV`]g\]b[ 'h\Ya gY`j Yg']b'h\Y XYj Y`cda YbhZ]Y`X"''H\Ymk Y`Wca Y`V`c[ g'UbX'ch\Yf'Wcblf]Vi h]cbg"

8YjDc`]WhiUh`\hhitult#pk:k/k/wk\wjvowc:]odh'ecof\_po`olo\_\pminYejoninfWfiZoef`Kod\VUhYoj`bbe`y w%oolo%oome blogs and other

XYi Y`cda Ybh7lY

Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g

Gi Va ]gg]cb cZ5ggYgga YbhHUg\_g

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

D`U[]Uf]ga `]g`i g]b[ 'h\Y`k cfXg`cf`]XYUg`cZch\Yfg`UbX`dfYgYbh]b[ 'h\Ya `Ug`mci f`ck b"'=hWJb'hU\_Y`a Ubm Zcfa gžZfca `XY`]VYfUhY`W\YUh]b[ 'hc`UWW]XYbhU`mWcdm]b[ 'Zfca `U`gci fWY'k ]h\ci hUW\_bck `YX[ Ya Ybh'

IBGK [fcidgdu[]Uf]ga ]bhch\yzc``ck]b[ WUhY[cf]Yg.

7 cdm]b[.'i g]b['h\Y'gUa Y'cf'j Yfmg]a ]`Uf'k cfXg'hc'h\Y'cf][]bU`hYl h'cf']XYU'k ]h\ci h'UW\_bck `YX[]b['h\Y gci fW'cf'i g]b['ei chUh]cb'a Uf\_g"'H\]g'U`gc'Udd`]Yg'hc']a U[Ygž'Ufh'UbX'XYg][b'dfcYWhgž'Ug'k Y``'Ug dfYgYbhUh]cbg'k \YfY'gca YcbY'dfYgYbhg'Ubch\Yf'g']XYUg'cf'k cfXg'k ]h\ci h'WfYX]h'

⇒ Uddfcdf]UhY 'dUfUd\fUg]b[...7\Ub[]b[ 'U'ZYk 'k cfXg'UbX'd\fUgYg'k \]'Y 'a cghmfYhJ]b]b[ 'h\Y'cf][]bU` ghfi Wh fY 'UbX#cf'dfc[fYgg]cb'cZ]XYUg'cZh\Y'cf][]bU'žUbX']bZcfa Uh]cb'k ]h\ci hUW\_bck `YX[Ya Ybh'H\]g'U`gc Udd`]Yg']b'dfYgYbhUh]cbg'k \YfY'gca YcbY'dUfUd\fUgYg'Ubch\Yf'g']XYUg'cf'k cfXg'k ]h\ci hWfYX]hUbX'hc d]YW]b[ 'hc[Yh\Yf'ei chYg'UbX'dUfUd\fUgYg']bhc'U'bYk 'k \c`Yžk]h\ci hUddfcdf]UhY'fYZYfYbW]b[ "

7 c``i g]cb.'k cf\_jb['k]h\ch\Yfg'Vi hdUgg]b['cZZh\Y'k cf\_'Ug'U'dYfgcb'g']bX]j ]Xi U``k cf\_"'7 c``i g]cb'U`gc ]bWi XYg'dfcj ]X]b['mci f'k cf\_'hc'Ubch\Yf'ghi XYbhVYZcfY'h\Y'Xi Y'XUhYžcf'Zcf'h\Y'di fdcgY'cZh\Ya d`U[]Uf]g]b['UhiUbmh]a Yž'dUm]b['Ubch\Yf'dYfgcb'hc'dYfZcfa 'Ub'UWUXYa ]WhUg\_ž'ghYU']b['cf'UWei]f]b[ Ubch\Yf'dYfgcb'g'UWUXYa ]Wk cf\_'UbX'Wcdm]b[']hz'cZYf]b['hc'Wca d'YhY'Ubch\Yf'dYfgcb'g'k cf\_'cf'gYY\_]b[ dUma YbhZcf'Wca d'Yh]b['UWUXYa ]Wk cf\_"

±bUddfcdf]UhY`W]hUh]cb.`7]h]b[ˈgci fWYg'k\]WX`\Uj Y`bchVYYb`fYUXžk]h\ci hUW\_bck`YX[]b[`h\Y`″gYWcbXUfm″gci fWY`Zfca 'k\]WX`\_bck`YX[Y`cZh\Ya`\Ug'VYYb`cVhU]bYX"

8 i d`]\W\n]cb`ffgY`Z\d`U[]\Uf]ga "Ł`gi Va]\n]b[`mci f`ck b`k cf\_z`]b`k \c`Y`cf`]b`dUffz`k \YfY`]h\Ug`dfYj]ci g`m VYYb`dfYdUfYX`cf`gi Va]\nYX`Zcf`Ubch\Yf`UggYgga Ybhcf`\\cf\\text{i fgY`UhI\_BGK\_`cf`Ubch\Yf`i b]j Yfg]\m'

7 cffYWnfYZYfYbWlb[ 'dfUWnWyg.

- DUfUd\fuqlb[ žqi a a Uf|q]b[ žYggUmk f]h]b[ UbX h]a Y a UbU[ Ya Ybh
- 5 dd fodd f]Uhr dyf c lloub llfor i lloub llf

- i bXYfgHUbX'mci f'f][\hg'UbX'fYgdcbg]V]`]h]Yg'Ug'U'gh XYbhUhI BGK
   VY'Uk UfY'cZd`U[]Uf]ga ž'Wcdmf][\hz'I BGK 'Gh XYbh7cXY'cZ7cbXi WhUbX'5VWWdhUV`Y'I gY'cZ IBGK =7 HF Ygci fWrg Dc`]Wh

#### 5 WUXYa ]W = b Zcfa Uh cb ·

: cf`YggYbhJU``gh XYbh`]bZcfa UhJcb`fY`UhJb[ 'hc.

- fYei Yghg Zcf Yl hYbg]cb/
- `UhY`gi Va ]gg]cbg`[ i ]XY`]bYg/
- fYj ]Yk 'cZa Uf\_g/
- I BGK '< YU`h\ 'UbX'GUZYhmdc`]\\\Yg/
- YI Ua ]bUh]cb dfcWYXi fYg/
- gdYWJU``Wcbg]XYfUhjcb`]b`h\Y`Yj YbhcZ]``bYgg`cf`a ]gUXj Ybhi fY/
- gh XYbhYei ]mUbX X]gUV]`]m/
- UbX'ch\Yf'YggYbhJU`'UWUXYa ]W]bZcfa UhJcbž'gYY

\hdg.#k k k "Uffg"i bgk "YXi "Ui #W ffYbhgh XYbhg#UWUXYa ]W]bZcfa Uf]cb#dfchcWc`g![i]XY`]bYg#

### a U[Y⁻7fYX]h

 $fP f]g\bU'G\fYgh\U'&$ \$% Ł

#### 7F = 7CG

7F = 7CG Dfcj ]XYf 7cXY. \$\$\$-,;