## Y GUVGTP"KNNKPQKU"WPKXGTUKV [ "HCEWNV [ " UGPCVG"Tgiwnct"Oggvkpi."26 October, 2021."6<22"r0 o 0 Wpkqp"Ecrkvqn"Tqq o u1 \ qq o "

#### $\mathbf{C}^{"}\mathbf{E}^{"}\mathbf{V}^{"}\mathbf{K}^{"}\mathbf{O}^{"}\mathbf{P}^{"}\mathbf{P}^{"}\mathbf{O}^{"}\mathbf{K}^{"}\mathbf{P}^{"}\mathbf{W}^{"}\mathbf{V}^{"}\mathbf{G}^{"}\mathbf{U}$

 $\begin{tabular}{ll} $UGPCVQTU"RTGUGPV<"F0"Cvjgtvqp."F0"Dcpcuj."O0"Dgtpctfu."N0"Dtkeg." I 0"Ecdgfq/Vkooqpu."L0"Ejqk."N0"Gdgtv" $$Y cnnceg."T0"Hknkrkpm."L0"Mcuvgn."L0"Ncpf."K0"Ncwgt."V0"Nqwij."U0"Oceejk."F0"Qwtungt."L0"Tqdkpgvv."T0"Ucyjpg{."G0"Ujwrg."U0"U|{lmc."[0"Vcpi."G0"Vc{nqt."L0"Ytqdngyumk}$$ $$Gz/qhhkekq<"Dknn{"Enqy."Kpvgtko"Rtqxquv="Dgvu{"Rgtcdq."Rctnkcogpvctkcp}$ \end{tabular}$ 

 $UGPCVQTU"CDUGPV < "U0"Dckng \{."U0"Eqtfgu."D0"Vjqoruqp" \} \\$ 

K0" Eqpukfgtcvkqp"qh"Okpwvgu"

C0 Qevqdgt"34."4243"

CRRTQXGF"CU"FKUVTKDWVGF"

KK0" Cppqwpeg o gpvu"

C0" <u>Rtqxquv)u"Tgrqtv</u>"

 $\label{lem:convergence} \begin{tabular}{ll} Kpvgtk\ o\ "Rtqxquv" Enq\ y\ "cppqwpeg\ f"v\ j\ cv"v\ j\ ku"\ y\ ggm"v\ j\ g"Eqxk\ f"xceekpcvkqp"tcvg"hqt"hcewnv\ {"cpf"uvchh"ku":9"rgtegpv"cpf"hqt"uvwfgpvu"kv"uvcpfu"cv"87"rgtegpv=";;08"rgtegpv"qh"hcewnv\ {"cpf"uvchh"ctg"eq\ o\ rnkcpv"\ y\ kv\ j"Eqxk\ f"rtqvqeqnu."cpf":906"rgtegpv"qh"uvwfgpvu"ctg"eq\ o\ rnkcpv0"\ J\ g"cumg\ f"hcewnv\ {"vq"tg\ o\ kpf"uvwfgpvu"qecukqpcnn\ {"cdqwv"v\ j\ g"pgg\ f"vq"eq\ o\ rn\ {"y\ kv\ j\ "Eqxk\ f"\ i\ wkfgnkpgu0"} } \end{tabular}$ 

 $Cu"qh"ncuv"\ y\ ggm."vj\ gtg"53"cr\ rnkecvkqpu"uwd\ o\ kvvg\ f"hqt"vj\ g"Rtqxquv"Vtcxgn"C\ y\ ct\ fu"6"42"vgpwtg\ f"hcewnv {"cpf"33"htqo"vgpwtg"vtcem"hcewnv {0"Kpvgtko"Rtqxquv"Enqy"uvcvg\ f"vj\ cv"vj\ gtg"ctg"c"hckt"pw\ o\ dgt"qh"cy\ ct\ fu"uvknn"cxckncdng."cpf"vj\ g"cr\ rnkecvkqp"rtqeguu"\ y\ knn"tg\ o\ ckp"qrgp"vj\ tqw\ i\ j"vj\ g"gpf"qh"vj\ g"ug\ o\ guvgt0"$ 

 $\label{lem:constraint} \begin{tabular}{ll} Kpvgtk\ o\ "Rtqxquv" Enq\ y\ "uvcvg\ f"vj\ cv"c" dtkgh" egtg\ o\ qp\ \{"\ y\ cu"j\ gnf"vq\ fc\ \{"vq"kpvgt"vj\ g"cuj\ gu"qh"\ I\ kn"Dgnngu"kp"\ Y\ KW\emptysetu"pg\ y\ "eqnw\ o\ dctkw\ o\ ."\ y\ j\ kej\ "ku"nqecvg\ f"gcuv"qh"Uj\ gt\ o\ cp"\ J\ cm"pgct"vj\ g"\ O\ g\ o\ qtkcn"Vtgg"Rctm0"\ J\ g"uvcvg\ f"vj\ cv"Ft0"Dgnngu"rcuug\ f"c\ y\ c\ \{"hqwt"\ \{gctu"c\ i\ q"chvgt"j\ ku"tgvktg\ o\ gpv"htq\ o\ "Y\ KW\emptysetu"Fg\ rctv\ o\ gpv"qh"\ Tgetgcvkqp."Rctm"cpf"Vqwtku\ o\ "C\ f\ o\ kpkuvtcvkqp"cpf"nghv"hwpfu"vq"etgcvg"c"eqnw\ o\ dctkw\ o\ "hqt"vj\ g"\ Wpkxgtukv\ \{0"Ft0"Dgnngu"\ y\ cu"vj\ g"hktuv"rgtuqp"vq"dg"kpvgttg\ f"kp"vj\ g"pg\ y\ "eqnw\ o\ dctkw\ o\ 0"\ \end{tabular}$ 

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#### E0" <u>Uvwfgpv" I qxgtp o gpv"Cuuqekcvkqp"Tgrqtv"</u>

 $* Eqf \{ "Eqtpgnn." UIC" tgrtgugpvcvkxg" vq" Hcewnv \{ "Ugpcvg+" tgrtgugpvcvkxg" vq" Hcewnv \} \} \\$ 

 $U\,I\,C''\,o\,gv''\,y\,kv\,j\,''Tgdgeec\,''Uncvgt.''Fktgevqt''hqt''Wpkxgtukv\,\{\,''Vge\,j\,pqnq\,i\,\,\{\,.''vq''\,fkuewuu''kuuwgu''tg\,i\,ct\,fkp\,i\,''v\,j\,g''\,472/r\,c\,i\,g''\,r\,tkpvkp\,i\,'''h\,o\,kv0''\,O\,t0''\,Eqtpgnn''tgncvg\,f''v\,j\,cv''v\,j\,g''\,o\,ckp''v\,j\,kp\,i\,''U\,I\,C''vqqm''htq\,o\,''v\,j\,ku''\,o\,ggvkp\,i\,''y\,cu''\,v\,j\,cv''\,c''nqv''qh''uvw\,f\,gpvu''v\,j\,qw\,i\,j\,v''v\,j\,cv''\,r\,tkpvkp\,i\,''wr\,''vq''472''\,r\,c\,i\,gu''\,y\,cu''htgg.''dwv''kv''tgcnn\,\{\,''ku''pqv''dgecwug''\,uv\,v\,j\,cv''\,r\,tkpvkp\,i\,''wr\,''vq''\,472'''\,r\,c\,i\,gu''\,y\,cu''htgg.''dwv''kv''tgcnn\,\{\,''ku''pqv''dgecwug''\,uv\,v\,j\,cv''\,r\,tkpvkp\,i\,''wr\,''vq''\,472'''\,r\,c\,i\,gu''\,y\,cu'''htgg.''dwv''kv'''tgcnn\,\{\,''ku'''pqv'''dgecwug''\,uv\,v\,j\,cv''\,r\,tkpvkp\,i\,''wr\,''vq''\,472'''\,r\,c\,i\,gu''\,y\,cu'''\,ty\,g'''\,v\,j\,cv'''\,ty\,g'''\,v\,j\,cv'''\,ty\,g'''\,v\,j\,cv'''\,ty\,g'''\,v\,j\,cv'''\,v\,j\,cv'''\,v\,j\,cv'''\,v\,j\,cv'''\,v\,j\,cv'''\,v\,j\,cv''\,v\,j\,$ 

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Ejckt"Ncwgt"tgoctmgf"vjcv"jg"nkmgu"vjg"eqortgjgpukxg"pcvwtg"qh"vjg"rncp"cpf"vjcv" gxgt{vjkpi"ku"dgkpi"tggzcokpgf0"Ugpcvqt"Dgtpctfu"cumgf"vjcv"Gptqnnogpv"Ocpcigogpv" pggfu"htqo"hcewnv{"vq"gpjcpeg"tgetwkvogpv0" Jg"cnuq"cumgf"kh"fkuewuukqpu"ctg"dgkpi"jgnf" tgictfkpi"jqy"vq"u{uvgocvkecm{"ocmg"rtqitcou"oqtg"cvvtcevkxg0"Xkeg"Rtgukfgpv"Uejwnv|" tgoctmgf"vjcv"vjg"Wpkxgtukv{"jcu"vjg"qrrqtvwpkv{"tkijv"pqy"vq"uvctv"vjkpmkpi"gxgp"oqtg" uk o rn{"vjcp"jqy" Y KW"ecp" o cmg"kvu" rtqitc o u" o qtg"cvvtcevkxg="vjg" swguvkqp"ku" jqv "vq" kfgpvkh{"vjg"uvtqpiguv"hgcvwtgu"cpf"dgpghkvu"qh"gcej"qh"YKWøu"cecfgoke"rtqitcou"cpf"ocmg" uwtg"vjcv"vjqug"ctg"kp"vjg"jcpfu"qh"vjg"htqpv/nkpg"tgetwkvogpv"uvchh0"Ujg"uvcvgf"vjcv"octmgvkpi" uvchh"ctg"vt{kpi"vq"jgnr"fgvgtokpg."htqo"c"dcugnkpg."yjcv"ujqwnf"dg"eqoowpkecvgf"vq" uvwfgpvu."cpf"vjg"pgy"GTR"\*Gpvgtrtkug"Tguqwteg"Rncppkpi+"u{uvgo"ujqwnf"jgnr"ykvj"vjg" ETO"\*Ewuvq o gt"Tgncvkqpu jkr"Ocpc i g o gpv+"eq o rqpgpv0"U jg"pqvgf"v jcv" Y KW"ku"c"nkvvng" dgjkpf"vjg"icog"dgecwug"vjgtg"jcu"dggp"pq"tqdwuv"eqoowpkecvkqp"rncp"kp"rnceg."dwv"vjcv"ku" dgkpi "k o rng o gpvg f"cu"kv"ku"dwknv"uq"vj cv"vj g"Wpkxgtukv{"ecp"ugp f" o qtg" o guuci gu"vq"uvw f gpvu" ctqwpf"vjqug"cecfgoke"hgcvwtgu"cpf"dgpghkvu0"Ujg"tgkvgtcvgf"vjcv"Cfokuukqpu"jcu"dggp" eqpfwevkpi "vtckpkpi uguukqpu"hqt"vjgkt"eqwpugnqtu"cpf" y knn"dg"hqewukpi "qp"vjgug" jgcxkn{"cv" vjg"dgikppkpi"qh"vjg"{gct0"Ujg"uvcvgf"vjcv"kv"yknn"dg"jgnrhwn"vq"mpqy"yjcv"ku"oquv"cvvtcevkxg" vq"pgy"uvwfgpvu"kp"gcej"cecfgoke"rtqitco0"Xkeg"Rtgukfgpv"Uejwnv|"ku"cnuq"c"dki"rtqrqpgpv" qh"cfxkuqt{"dqctfu."yjkej"rtqxkfg"eqppgevkqpu"vq"dwukpguu."kpfwuvtkgu."cpf"itcfwcvg" uejqqnu."cpf"jcu"cntgcf{"jcf"vjg"qrrqtvwpkv{"vq"urgcm"vq"c"hgy"qh"vjgo0"Ujg"uckf"rtqurgevkxg" uvwfgpvu" y cpv"vq"mpq y " y j cv"ku"pgzv"hqt"v j g o "kh"v j g { "ej qqug" Y KW."cpf" y j cv"g o rnq { gtu"pggf" htqo"YKf"dg" â

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## $XV^{"}$ Qnf"Dwukpguu"o"Pqpg""

# $\underset{"}{X0"} \qquad \underline{Pgy"Dwukpguu"}$

## C0 $Rtgukfgpvøu"Rqnke{"Eqookvvgg"}$

 $\label{linear_control_contro$ 

 $\label{lem:continuous} Eqoo okvvgg="htqo" Ejckt"Ncwgtøu"xcpvcig" rqkpv." GzEq" jcu" oqtg" fgvckngf" fkuewuukqpu"qh" oqtg" hcegvu" qh"kuuwgu0" Ugpcvqt" Hknkrkpm" rqkpvgf" qwv"vjcv" jg" cpf" Ugpcvqt" Dgtpctfu" jcxg" ejcktgf" ECICU"kp"vjg" rcuv." cpf"vjgtg" ctg" c"xctkgv{"qh" ugpcvqtu" ykvj" gzrgtkgpeg" tgngxcpv"vq" fkhhgtgpv" rqnkekgu0" Ejckt"Ncwgt" citggf" cpf" cumgf" kh" Ugpcvqt" Hknkrkpm" ku" uwiiguvkpi" vjgtg" ujqwnf" dg" oqtg" rctvkekrcvkqp" htqo" Hcewnv{" Ugpcvg"vjcp" ukorn{"uqogqpg" htqo" GzEq0" Ugpcvqt" Hknkrkpm" tgrnkgf" vjcv" jg" ku." gurgekcm{"dgecwug" jg" vjkpmu" kv"ku" xkvcn" hqt"vjg" Ugpcvg" vq" rnc{"c"ukipkhkecpv" tqng" qp"vjku" eqookvygg" cpf" dgecwug" jg" fqgu" pqv" ycpv" vq" rwv" gxgt{vjkpi" qp" GzEq0"" }$ 

 $\label{thm:continuous} Ugpcvqt"Dcpcuj"rqkpvgf"qwv"vjcv"vjgtg"ctg"rqnkekgu"gxgt\{yjgtg"kp"gxgt\{"fgrctvogpv"cpf"qhhkeg"cv"YkW0"Jg"uvcvgf"vjcv"vjgtg"yqwnf"pqv"dg"gpqwij"ugpcvqtu"vq"eqortgjgpukxgn\{"nqqm"cv"gxgt\{"rqnke\{"qp"ecorwu."cnvjqwij"vjgtg"okijv"dg"uqog"ogejcpkuo"yjgtgd\{"cp"gzgewvkxg"uwooct\{"tgrqtv"eqwnf"dg"fgxgnqrgf"qwvnkpkpi"vjg"oclqt"ejcpigu"vq"rqnkekgu"chvgt"vjg\{"ctg"tcvkhkgf."yjkej"eqwnf"dg"dtqwijv"vq"Hcewnv{"Ugpcvg"uq"vjcv"ugpcvqtu"eqwnf"dg"kphqtogf"kp"c"oqtg"inqdcn"yc{0"Jg"uckf"kp"vjku"yc{"kh"ugpcvqtu"ykujgf"vq"ocmg"uwiiguvkqpu"vjgtg"yqwnf"dg"c"ogejcpkuo"uq"vjcv"vjg{"eqwnf"fq"vjcv"tgurqpukdn{"dghqtg"vjg"ejcpigu"oqxgf"hqtyctf0"Ejckt"Ncwgt"vjkpmu"vjcv"yqwnf"dg"c"tgcuqpcdng"tgswguv0""$ 

#### D0 Hqt"vjg" I qqf"qh"vjg"Dqf{"

 $\label{thm:continuous} Ugpcvqt"Tqdkpgvvg"cppqwpegf"vjcv" o knkvct {"tgeqipkvkqp"cevkxkvkgu"yknn"dgikp"pgzv"yggm0"Cvjngvkeu"ku"jquvkpi"c" o knkvct {"crrtgekcvkqp"ic o g"qp"Oqpfc {."Qevqdgt"47."cpf"rcemcigu"ctg"dgkpi"rtgrctgf"hqt"YKWøu" o knkvct {"uvwfgpvu0"Eqt{"Dqqjgt."Octkpg"Eqtru"xgvgtcp"cpf"Rtgukfgpv"qh"vjg"YKW"Xgvgtcpu"Enwd."jcu"etgcvgf"c"rtgugpvcvkqp"qp"Tqem"Jcpuqp"cpf"yj{"YKWøu"vgcou"ctg"ecnngf"vjg"Ngcvjgtpgemu."cu"ygm"cu"c"ugv"qh"swguvkqpu"cdqwv"Tqem"Jcpuqp"vjcv"hcewnv{"ecp"wug"kp"vjgkt"encuugu0"Ugpcvqt"Tqdkpgvv"uckf"oknkvct{"crrtgekcvkqp"cevkxkvkgu"yknn"ewn}$