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VRFLDOHQYLURQP HQWRI WKHIXWXUH$, HUD + DYHWKHDELOLW\ WRFRQGHQVHFRUSRUDWHFXOWXUH SURSRVHGHYHORSP HQW SODQV DQGGHYHORS WKFKQRORJLFDOLQQRYDWLRQ FUJDQL]HUHVDUFK WKP ZRUNLQWKHLQWHOOLJHQWP DQXIDFWXULQJ HQWUSUHVHDQG$, LQGXVWULDOHVWDWHV EXLOGVHV HQYLURQP HQW3UHGP LQDLO SHUFHLYHVXFK H[SHULHQFHDQGDZDUHQHV DVFRQFHLYHGHVJQ LP SOHP HQWDWLRQ UXQ &', 2 $, P DQXIDFWXULQJ DQGVHUYLFHV HWF

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5 HTXLUHP HQW (QJLQHULQJ NQRZ ORGJH 6WXGHQWKDYHD VROGNQRZ ORGJHRI P DWKP DWFV QDXUDO VFLHQFH DQGWKHLU P DWKP DWFDOO P DXWUWKH EDVLF VWWP FRQFHQWLQJ IRXQGDWRQDQGSURHVLRQDNQRZ ORGJH LQWKHILHOGRI DUWLFLDOLQWHOOLJHQFH ZLWK ZKLFK WR VROYHFDQEHDOONQGVRI FRP SOH[NQRZ ORGJHSUREOP V XVHGLQ VXFK VSKUH LQDUWLFLDOLQWHOOLJHQFH FRP SOH[HQJLQHULQJ SUREOP V	6WXGHQWVKRXOGXQGHUWDQG DQGJUDVS WKHEDVLF NQRZ ORGJHRI WKHQDWXUD \FLHQFHV VXFK DV P DWKP DWFV SK\VLFV DQGKDYHDFHUWDLQ VHQVHRI P RGHUQ VFLHQFH DQGWHFKQRORJ\ P HWKRGRORJ\ 6WXGHQWVKRXOGXQGHUWDQG DQGJUDVS WKHEDVLF WKRU DQGEDVLF P HWKRGV RI DUWLFLDOLQWHOOLJHQFH XQGHUWDQGLQJ WKHEDVLF HQJLQHULQJ NQRZ ORGJH WKH\ WKP RI DUWLFLDOLQWHOOLJHQFH DQGFRP SXWDWRQDOWKLQNLQJ DELOLW ,QFXUUFXOP DXWKP HQWWXGHQW VKRXOGEHDEOHWR SUDFWH DQGJUDGXDWR GHVLJQ SDSHU WKHSSOFDWRQ P DWKP DWFDOOQGQDXUDOVFLHQFH HQJLQHULQJ SURHVLRQDONQRZ ORGJHWR VROYH FRP SOH[HQJLQHULQJ SUREOP LQDUWLFLDO LQWHOOLJHQFH V\ WWP VDQGSSOFDWRQV
5 HTXLUHP HQW 3UREOP DQDO\VLV 6WXGHQWVFDQ DSSO WKH EDVLF SULQFLSOHVRI P DWKP DWFV QDXUDO VFLHQFH DQGHQJLQHULQJ VFLHQFHWR SHUFRUP DEWUDFWLRQ DQG LGHQWLFDWLRQ RI SUREOP V DQG VROXWLRQ SDWKV 6WXGHQWVFDQ H[SHULPHQW RI P RGHODQ DQGLGHQWLI\ SUREOP V WKURXJK ODNHUHVHDUFK WR REWDLQ DQG DQDO\]H GDWD 6WXGHQWVDUH EHWWHU SSO WKH SULQFLSOHVRI P DWKP DWFV QDXUDOVFLHQFH DQGHQJLQHULQJ SUREOP V WKURXJK OLWHUDWXUH UHVHDUFK WR REVHUYH DQG DQDO\]H H[SHULPHQWDO DQG WKHRUHWLFDO SUREOP V	6WXGHQWVKRXOGEHDEOHWR SDSO WKH SULQFLSOHVRI P DWKP DWFV QDXUDOVFLHQFH DQGP HWKRGRORJ\ RI DUWLFLDOLQWHOOLJHQFH DQGEDVLF P HWKRGRORJ\ RI FRP SXWDWRQDOWKLQNLQJ DELOLW 6WXGHQWVKRXOGEHDEOHWR SDSO WKH SULQFLSOHVRI P DWKP DWFV QDXUDOVFLHQFH DQGP HWKRGRORJ\ RI DUWLFLDOLQWHOOLJHQFH DQGFRP SXWDWRQDOWKLQNLQJ DELOLW\ WR DSSO\ WKHVH SULQFLSOHVRI P DWKP DWFV QDXUDOVFLHQFH DQGHQJLQHULQJ SUREOP V WKURXJK UHDVRQDQGYHUI\ WKHFRP SOH[HQJLQHULQJ SUREOP VLQFRXUWHDXHVP HQWWDLQLQJ SUFHVV HWP H
5 HTXLUHP HQW ' HVLJQ GHYHORS VROXWLRQV 6WXGHQWVFDQ GHVLJQ VROXWLRQV WR FRP SOH[HQJLQHULQJ SUREOP VLQ WKH ILHOGRI DUWLFLDOLQWHOOLJHQFH DQG WWDUHWRP HHWWKH VSHFLILF QHHGV RI P RGXOHRUDUJRUWMP SURFHVV DQGFDQ	6WXGHQWVKRXOGP DWWUWKHEDVLF GHVLJQ SULQFLSOHRI DUWLFLDOLQWHOOLJHQFH WKFKQRORJ\ DSSOFDWRQ SUREOP VDQG WKHP HWKRG DQGFDQGHVLJQ UHDVRQDEOHVROXWRQ WR FRP SOH[HQJLQHULQJ SUREOP VUHDWG 6WXGHQWVKRXOGEHDEOHWR XQGUWDQG DQGJP DWWUWKHDUWLFLDOLQWHOOLJHQFH WKFKQRORJ\ RQWKHGHVLJQ P HWKRG DQG DSSOFDWRQ RI FRP SOH[HQJLQHULQJ SUREOP VUHDWG WR PHHW VSHFLILF QHHGV DQG FRQVWUDLQWV

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5HTXLUHPHQW 6FLHQWLFUHVHDUFK %HDEOHWRVWXG\ FRP SOH[SUREOP VRI DUWLFLDO LQWHOOLJHQFH VRIWZDUH DQGKDUGZDUH EHVHGRQVFLHQWLF SULQFLSOHVLQWHIILHOG RI DUWLFLDOLQWHOOLJHQFH DQGXVLQJ WKH VFLHQWLF P HWKRGDQG\ WKHP HQJLQHHULQJ LQFOXGLQJ GDWD DQGREVHUYDWLRQ UHVHDUFK EHDQG HIIHFWLYHFRQVLRQVKLSXJK LQRUP DWRQ \QWHVLV LQJ	6WXGHQWVKRXOGXQGHUWDQG DQGP DWWULWHDEOF WKHRU DQGP HWRGRORJ\ P HWRGRORJ\ 6WXGHQWVKRXOGEHDEOHWR XVHUHDEOH DQG HIIHFWLYH SURJUDPP LQJ VSHFLDOL]HG OLEUDULHV DQG WRROV IRU DXWRPDWLQJ WKH VRIWZDUH GHYHORSP HQW SURFHVV DQG WHVWLQJ
	6WXGHQWVKRXOGEHDEOHWRXVHUHDEOHYDQWWKRU DQGP HWRGV RI FRP SOH[FRP SXWHUVFLHQFH DQG DWWULFLDOLQWHOOLJHQFH HQJLQHHULQJ SUREOP VWRHWXDOLQJ TXDQWLWDWLYH RUTXDOLWDWLYH P RGHOV DQG SHUFRUP DQDO\VLV DQG FRQFOXVLRQ %HDEOHWR JUDVS WKHRULJLQDOGDWDFRQWHQWLQJ P HWRGV SDUP HWUDQDO\VLV P HWRGV WKHQGQ P HWRGV RI WKH UHVXOWV HP SHUP HQWDQG FRP SUHKHQVLYH DQDO\VLV P HWRGV	
	6WXGHQWVKRXOGEHDEOHWRUHVHDUFK DQG GHYHORS VROXWRQRI FRP SOH[HQJLQHHULQJ SUREOP V WKURXJK DFHWLQJQ QXP EHUFH GHVLJQ[SHUP HQW VLP XQDWRQ[SHUP HQW DQG UHVHDUFK SURMHFWRUD SURMHFWQ FRXUVHV[DP LQDWRUP DWRQ SUDFWLFH DQG JUDGXDWRQ GHVLJQ SDSHU	
5HTXLUHPHQW $ SSOLFDWRQRI DGYDQFHG WKRY 6WXGHQW KDYHDELOLW\ WRGHYHORS VHOFWDQG XVH DSSURSULDWH WHFKQRORJ\ \ RI WZR DUH KDUGZ DUH DQG \ WKP UHVRXUFHV P RGHUQ HQJLQHHULQJ UHVHDUFK DQG GHYHORSP HQW WRROV IRU DWRQ\ QXP HULFDO DQDO\VLV DQG VLP XODWLRQ RI FRP SOH[HQJLQHHULQJ SUREOP VLQ WKH SUHGLFWLRQ DQG LQYHVWLJDWLRQ RI FRP SOH[HQJLQHHULQJ SUREOP V DQG EH DEOHWRX QGHUVWDQG WKH LQIOXHQFH RI	6WXGHQWVKRXOGEHDEOHWR\VLQXOD XVHSURJUDP P LQJ P HWRG HQYLURQP HQWDQG \RROV LQFOXGLQJ SRVWZDUH GHYHORSP HQW RI DUWLFLDO LQWHOOLJHQFH DQG GHHS OHDUQLQJ SODWIRUP GHHS OHDUQLQJ HWF
	6WXGHQWVKRXOGEHDEOHWRP DXWRPDWHDSSOLFDWRQ RI DUWLFLDOLQWHOOLJHQFH \ \WKP IRUHQYLURQP HQWDQG GHYHORSP HQW\RRV HWF LQFOXGLQJ 3\WRQ DUWLFLDOLQWHOOLJHQFH DQG P DFKLQH OHDUQLQJ SODWIRUP GHHS OHDUQLQJ SODWIRUP HWF	
	6WXGHQWVKRXOGEHDEOHWRDQDO\]H DQG VLV DQG FRP SUDH SUHGLFWVDQG VLP XODWH FRP SOH[HQJLQHHULQJ SUREOP VE\ \HOHFWQJ DQG XVLQJ WKHP HWRGV RI DUWLFLDO LQWHOOLJHQFH SODWIRUP DQG \RROV DQG XQGHUVWDQG DQG GHVFUEH WKH OHDUQLQJ RI WKH \ROXWRQ\	
5HTXLUHPHQW (QJLQHHULQJ DQG \RFLHW\ 6WXGHQWVFDQ FRQGXFW UHVHDUFK DQG DSSO\ HDVH GRQ WKH EEDFN URXQG NQRZ OHGJH RI HYDOXDW DUWLFLDOLQWHOOLJHQFH DQG LQGLYLGXDO SUDFWLFH DQG FRP SOH[HQJLQHHULQJ \ROXWRQ\ SURREOP VRI \RFLDO KH DSSOLFDWRQ DQG GHJ DDDQG WKH LQIOXHQFH RI FXOWUH DQG XQGHUVWDQG DQG GHVLJQ DQG GHYHORS SURGXFWV DQG SURFHVVHV WKDW DUH FXOWXUDOOB UHVSRQVLEOH DQG XQGHUVWDQG	6WXGHQWVKRXOGXQGHUWDQG WKHEDVLF NQRZOHGJH RI VRFLHW\ \DH HW KH DQG XQGHUVWDQG LWVILQWHUDFWLRQ DUWLFLDOLQWHOOLJHQFH DSSOLFDWRQ \ \WKP HVSHFLDOO\ WKH DUWLFLDOLQWHOOLJHQFH DQG HEDFN URXQG NQRZ OHGJH RI HYDOXDW DUWLFLDOLQWHOOLJHQFH DQG LQGLYLGXDO SUDFWLFH DQG FRP SOH[HQJLQHHULQJ SURREOP V WKURXJK Z KFK SUHVHQWQJ WKH LUREOJDWRQ/ LQWUDUW DQG UHVSRQVLELOLW\
5HTXLUHPHQW (QYLURQP HQWDQG VXVWDLQDEOH GHYHORSP HQW6WXGHQWVKDYH DELOLW\ WR XQGHUVWDQG DQG HYDOXDWH HIIHFWV RI FRP SOH[HQJLQHHULQJ SUREOP VLQ WKH IIHOG RI DUWLFLDOLQWHOOLJHQFH DQGXVLQJ HWKLFDO UHDVRQLQJ DQG SURIHVVLRQDO SUDFWLFH	6WXGHQWVKRXOGKDYHEDVLF NQRZOHGJH RI WKH HQYLURQP HQWDQG WKH VXVWDLQDEOH GHYHORSP HQWDQG FRQFLRXVQHVV DQG XQGHUVWDQG WKH DUWLFLDOLQWHOOLJHQFH DSSOLFDWLRQ HQYLURQP HQWDQG WKH LQIOXHQFH RI VXVWDLQDEOH GHYHORSP HQWDQG LP SRUWDQFH
	6WXGHQWVFDQ XQGHUVWDQG FRP SOH[HQJLQHHULQJ SUREOP VRI DQ HQJLQHHULQJ SUDFWLFH DUH OHQ\ WKLP SDFWHQYLURQP HQWDQG VXVWDLQDEOH GHYHORSP HQW FDQ SHUFRUP DQDO\VLV DQG HYDOXDWLRQ RQ WKH LP SDFWV RI SURSRVHG VROXWLRQV IRU\SHFLILF SUREOP VRQ HQYLURQP HQWDQG VXVWDLQDEOH GHYHORSP HQW	

5HTXLUHPHQW 3URFHVVRQDOOR V 6WDQGDUGKDYH KXP DQWHV \RFLDOVFLHQFHQMMUDF\ DQG \RFLDOVHQJHRI UHVSRQVLELOLWV EHDEOHVR XQGHUWDQG DQGNHHS SURFHVVRQDOHMLFV DQGORUP V LQ\WHSURFHVRI HQJLQHLQJ SUDFWHDQGIXOLOOUHVSRQVLELOLWV	+ XP DQLWF TXDOLV KDYHDVFLHQWLF RXWRFNRQWHZRUGG OIHDQGYDOXHV FDQ FRUHFW XQGHUWDQG\WHILGLYLGXDOV SRVWRQLQ\WHVFLHW KLWRU DQGQDWUDO HQYLURQ WDQG\HDVHQHRI UHVSRQVLELOLWV EHDEOHVR SURPRWHQDWDQGKDYHDVHQHRI UHVSRQVLELOLWV \RFLDOSURJUHVV
	3URFHVVRQDOOR V 8QGHUWDQG\WHSURFHVRQDOOQDWUHDQGUHVSRQVLELOLWV RI HQJLQHLQJ \WFKQFLDQV XQGHUWDQG DQGEHLGHE\ HQJLQHLQJ SURFHVVRQDOHMLFV DQG QRUP V LQ\WHSUDFWFHRI DWWLFDOOQMQDJHQFHQJLQHLQJ DQGIXOLOOFRUHVSRQGLQJ UHVSRQVLELOLWV
5HTXLUHPHQW ,QGLYLGXDODQG\WDP 6WXGHQWVFDQ XQGHUWDN HWKHURGHVDVLQGLYLGXDO\WDP P HP EHU DQG\WKHKDG UHVSHFWLYHD XQGHU \WHP XQWLOVFLSOLQDU EDFNJURXQG	6WXGHQWVKRXOG XQGHUWDQG\WHLP SRUWDQFHRI UHVSHFWLQJ LQGLYLGXDOLJKWVDQG LQMHUVW XQGHUWDQG\WHUHDWRQKLS EHWZHHQ\WHILQGLYLGXDOJURXS DQG\RFLHW XQGHUWDQG\WHILQMHUHVWRI \WHILQGLYLGXDODQG\WDP XQLW DQG\WHURDHR \WHKHDGDQG \WDP P HP EHUV
	6WXGHQWVKRXOG DWWQGFHUWLQFURWV IDFXOW RUFURVV SURHVWRQDOHMLFV RUFRP SHWWRQV DQGRWKHUDWWLWXGH RUSDWWHUQ HQJLQHLQJ SUDFWH \RFLDOSUDFWH SXEOF ZHOIUHDFWLWXGH UHVHDUK HW DQGEHDEOHWR SDV \WHLUROH LQ\WHP
5HTXLUHPHQW &RP P XQLFDWRQ 6WXGHQWVKDYH DUWLFLDO LQMQDJHFH UHDGWG\WR FRP SOH[HQJLQHULQJ SUREOP VDQG\WR FRP P XQLFDWH IHFWLYHO ZLWK\WH LQGXWU SH HUVDQG\WH\RFLDOSXEOF FRP P XQLFDWRQ LQFOXGLQJ ZULWQJ UHSRUW DQGGHVJQLQJ GRFXP HQW \SHFK SUHVHQWDWRQ FODU[SUHVLRQ RU UHVSRQGLQJ \WR FRP P DQG\ DQGKDYHD FHUWLQ LQMQDWRQDOYLVRQ\WR XQGHUWKH EDFNJURXQG RI FURW FXOWUDO FRP P XQLFDWRQ DQGH[FKDQJHV	6WXGHQWVKRXOGKDYH SURHVLRQDO RUHJQODQJXDJH DQGUHWHYDOELOW DQG UHWHYDOELOW\WR FRP P XQLFDWRQ DQG ZULWQJ \NLOOV DQGZLWK LQMQDWDRQDOYLVRQ \WH FDQ FRP P XQLFDWH XQGHUWKH FFURW FXOWUDOEDFNJURXQG
	6WXGHQWVKRXOGEHDEOHWR FRP P XQLFDWH IHFWLYHO ZLWK FDOWP DW\ SHHUV DQG \WH SXEOF RQFHUQLQ FRP P XQLFDWRQ SDG\ RU\WRQ\ SUREOP VLQDYDUHW RI \WFKLQJ DQG SUDFWH LQFXOLQJ ZULWQJ UHSRUWV DQGGHVJQ GRFXP HQW \SHFK SUHVHQWDWRQ DW\FXOWUDOO RI LGHDV DFWWQJ UHSRQVHWR TXHVWRQV DQG \RRQ
5HTXLUHPHQW 3URMHFWP DQDJHP HQW6WXGHQWVDUHDEOHWR XQGHUWDQG DQGJUDVS \WHSUQFLSOHRI SURMHFWP DQDJHP HQW\DQGP HWKRGV\RI HFRQRP LF GHFLVRQ DSSOHG LQD P XQWLVFLSOQDU HQYLURQP HQW	6WXGHQWVKRXOGXQGHUWDQG DQGJUDVS \WHJHQHUDOSURMHFWSDQQLQJ DQG P DQDJHP HQW\SURMHFW\FLVRQ P DNLQJ DQGHFRQP \ \WHEDVF NQRZ OHGJHDQG P HWKRG DQG\WHFXUHQW\HDW\G LQGXWUHV\KDYHDFHUWLQ XQGHUWDQGLQJ RI DWWLFDO LQMQDJHFH
	,QFXUUFXOP DW\HP HQW\WXGHQWVKRXOGEHDEOHWR XQGHUWDQG DQGDSSO\ SURMHFW\P DQDJHP HQW\WKRU\ DQGP XQWLVFLSOQDU NQRZ OHGJHVXFK DV\HFRQP LF GHFLVRQ P HWKRG\WR\ROHFFRP SOH[HQJLQHULQJ SUREOP VLQFRXUHDW\HP HQW SUDFWHDQGIXOLOOHWKLFDO DQGJUDGXDWRQGHWLQ \WHHV
5HTXLUHPHQW ,QGHSHQGHQW\DQGHYHUDWXQQ OHDUQLQJ SHUHYHUDQFH 6WXGHQWVKDYHWKH FRQVFRX\QHVV RI FRQWQQW\DQGFRQQXRXV OHDUQLQJ DQG\WHDELOW\ \RDGDS\WR\WKH GHYHORSP HQW\RI DWWLFDOLQMQDJHFH \WFKQRORJ\	6WXGHQWVKRXOGEHDEOHWR XQGHUWDQG\WHLP SRUWDQFHDQGQHFHVVW RI DX\WRQRP RXVOHDUQLQJ DQGGLHORJ OHDUQLQJ \WR P DX\WUDFHWQLQP HWKRG RI DX\WRQRP RXVOHDUQLQJ DQGGLHORJ OHDUQLQJ
	6WXGHQWVKRXOGEHDEOHWR GP RQ\WDW\WHFRQVFRX\QHVV RI LQGHSHQGW\ OHDUQLQJ DQGGLHORJ OHDUQLQJ LQ\WHSURFHVRQDOPFKLQJ DQGSUDFWH DQGUHOFW \WHDELOW\ RI DX\WRQP RXVOHDUQLQJ DQGGLHORJ OHDUQLQJ

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%DVLVFRPSXWDQDOVV ' LJLWDO&HOHFWURQLFVWHFKQRORJ\ \$QDORJ HOHFWURQLFVWHFKQRORJ\ \$XWP DWF FRQWRO VWHRU ,QWURGXFWRQWR FRQQXWHSV\FKRORJ\ ,QWURGXFWRQWR1HXURELRORJ\ ) XQGP HQWDOVVR\$UWLFLDO ,QWHOOLJHQFH0 DFKLQH&HDUQLQJ 1DWXUDOODQJXDJHSURFHVVLQJ &RP SXWHUYLVLRQDQG3DWWHUQ5HFRJQLWLRQ ' LJLWDOP DJHSURFHVVLQJ 1HXUDOQHWZRUNDQG'HHS&HDUQLQJ ,QWHOOLJHQW\VWP GHVLJQHW

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		) RUHLJQ/ DQJXDJH&RXUVHV				
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	6SHFLDOL]HG 3UDFWLFH6HVVLRQV		3UDFWLFH			
&RPSHWHQF\ ' HYHORSP HQW	,QGLYLGXDOL]HG &RXUVHV		&RPSXOVRU\ RU3UDFWLFH			
([WUDFXUULFXODU SUDFWLFH	([WUDFXUULFXODU *HQHUDO(GXFDWLRQ 3UDFWLFH	&XOWXUHDQG6RFLHWLHV3UDFWLFH	([WUDFXUULFXODU 3UDFWLFH			
		0 HQWDO DQG3K\VLFDO 3UDFWLFH				
		) RUHLJQ/ DQJXDJH3URILFLHQF\ 7UDQVLQJ 3UDFWLFH				
	([WUDFXUULFXODU &KDUDFWHULVWLF 3UDFWLFH	,QQRYDWLYH7UDQVLQJ				
		,QQRYDWLRQ&RPSHWLQJ				
		&KXDQJN-HDFWLYLWLHV				
	&DUHHU(GXFDWLRQ	* URZWK3DQQLQJ &RXUVHV				
7RWDO3URSRVHG						

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7DEOHR 7HDFKLQJ 6FKHGXOHIRU$UWLFLDO,QWHOOLJHQFH0 DVWHU

&RXUH7\SH	&RXUH1DPH		&RXUH&RGH	&RXUH1DPH	&UH	7 & +	&UHGLW-RXU' LVWULEXWRQ				: HHNO + RXU3HU6HPHVWHU								1RWHV
							/ HF	([S	3UR	3UD	VW	QG	UG	WK	WK	WK	WK	WK	
* HQHUDO (GXFDWRQ	&RP SXWHUV	,GHRQWLFDOOQG 3RODWFDO&RXUHV		_,GHRQWLFDO0 RUDOVDQGVWH5XQHR / DZ															
				_2XWQHR &KLQHVH&RQWP SRUDU DQG0 RGHUQ +LVWRU															
				_1QWRGXFWRQ WR; L-LQJLQJ 7KRXJKWRQ6RFLDOP ZLWK&KLQHVH&KDUDFWHULVWLFVIRUD1HZ (UD															
				_%DVF3UQFLSOHVR 0 DLVP															
				_0 DR=HGRQJ7KRXJKWDQG7KHRU R 6RFLDOP ZLWK &KLQHVH&KDUDFWHULVWV															
				_&XUHQW6LWXDWRQDQG3RDFHV															
		) RUHJQ/ DQJXDJH &RXUHV		Þ _&RQHH(QJQDK Þ															
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