

## **Exam sample answers for MSc HCI**

### **Alan Dix**

#### **Sample Answer 1**

The aim of this is partly to give more opportunity to get credit for individual reflection on substantial coursework and partly to distinguish those who were actively engaged from those who were free-riders!

Each coursework is different so no real sample answer here, but things I'm looking for ...

- (i) Easy marks to get them started
- (ii) They may not have thought of this explicitly in relation to their coursework, but was discussed several times in relation to examples.
- (iii) Will give one mark for simply giving each example and extra 2 marks each depending on quality of description.
- (iv) The focus is on how they would tackle outstanding problems using a user-centred way of thinking. Possible answers would include more detailed scenarios, user testing, experiments, formal analysis.

## Sample Answer 2

- (i) Different properties of a network/telecomms channel
- bandwidth – amount/rate of information transfer
  - latency – average end-to-end delay
  - jitter – variation in delay
- (ii) This answer may be organised as media within sites (as here) the other way round, or a mix.
- X–A – high bandwidth, low delays and low jitter – good for everything!
- X–B – high latency will behave badly with both audio and video for interactive conversations (a) & (b). In particular, normal conversation has very small gaps (fraction of a second) which are used by participants to hand-over to one another. The participants will have problems similar to trans-continental satellite links.  
The high latency will not hinder streaming video/audio which can simply be slightly delayed.
- X–C – low bandwidth – will mean high compression and/or loss of quality. This will rule it out for Hi-Fi audio and high quality video. Interactive audio may cope (depending on how low the bandwidth) and web cam can simply have reduced frame rate and resolution.
- X–D – high jitter – (without buffering) will mean that both interactive and streaming audio will be badly affected (we can not stand delays/missing parts of speech). The interactive video will simply occasionally have broken frames which is acceptable. Depending on the level of jitter this will probably mean the quality is too bad for hotel video application.
- (iii) Buffering can be used to change jitter into delay (there are various diagrams of this in the course notes, or they can simply describe why). This effectively means that X–D can then be used for streaming audio/video, but still not suitable for interactive audio except at 'trans-Atlantic' style quality.
- (iv) In case X–B, the applet based solution would be necessary to achieve good interactive feedback for free-hand drawing. However, applet security would mean that the server would need to sit on the same machine as the web server (or need signed applet). Also the software will need to be more complicated as there will be the possibilities of race conditions when updates are done simultaneously by different participants. Feedthrough will also be poor.  
In case X–C, the central server solution may be chosen as the low latency and jitter mean that it can give fully interactive feedback even for mouse movements (ideally students may quote figures of around 200 ms maximum round trip feedback time for this). This will have an easier implementation. There may still be problems however in updating photo images on the individual displays, perhaps a delay when the application is first launched as the photos are downloaded over the low bandwidth connection. Feedthrough better.

### Sample Answer 3

- (i) Lots of possible things in each category, for example:
- Presentation/lexical – colours of buttons, labels on buttons, words in audio warnings, layout of control panel, ...
  - Dialogue/syntactic – need to conform alarm-red state and emergency shutdown, STNs, enabling of manual override in red state, ...
  - Application/semantic – change of actual target values, contacting of emergency services, control of exploding bolts,
- (ii) Switch is about rapid semantic feedback (under dialogue control), and is for things like line drawing, highlighting of icons based on detailed semantic differences. The buttons etc. on the control panel don't really need this rate of feedback.
- (iii) CS.4 – no '+' transition from RED state, no '-' transition from GREEN state. Suggest that these should simply do nothing, but perhaps have an audible beep so that you know that the action is being ignored.  
CS.5 – no '+' transition from TEMP or RED states. No '-' from GREEN and TEMP state. CONFIRM and CANCEL undefined from nearly all states. Would suggest doing nothing (with beep) for all except '-' from TEMP state. In this state the system looks similar to RED state which suggest that '-' should take the system back to AMBER. This also means that '+' followed by '-' always gets you back to the same state. Students may also notice that the TEMP state and RED state are indistinguishable – perhaps make TEMP state be flashing red light?
- (iv) There was a potential for accidentally getting into state RED, which is a 'dangerous state' of the STN. The CONFIRM button reduces the likelihood of an accidental RED state (perhaps there had been too many false alarms before the consultant's visit?). If the student is observant or has done question 4 before this, may also notice that there is a potential for missing the CONFIRM action and thus dangerously failing to get into RED state.

#### Sample Answer 4

- (i) Red represents danger (cultural, but pretty universal), so good to represent alert state and for emergency shutdown and confirm button. Similarly green represents safety. In UK and some countries green/amber/red also used for traffic lights, and alarm panel reflects this (recruiting real world knowledge). Red also good to grab attention and seems 'close' (visual perception and 3D vision), so good choice for making CONFIRM button obvious when it needs to be pressed  
But . red/green colour blind users would have some problems. The alarm state indicator is fine as colour is a redundant cue and can simply use location, butt perhaps text label would help. The conform button however fails completely as the only way f telling it needs to be pressed is the green to red colour change which would be invisible. Perhaps making it red and flash would be better
- (ii) The sub-panels give some logical grouping, especially good for original alarm control, but spoilt a bit with revised alarm behaviour where the CONFIRM button is part of the same logical interaction – perhaps an additional CONFIRM button on the Alarm panel would have been better. The location of Emergency shutdown immediately above the CONFIRM does emphasise both grouping and sequence, but perhaps should either be part of same panel or have a line/coloured box drawn on the control panel linking them.  
The manual override controls are all grouped together, but the position and layout of the keypad are unusual (?problems for left handed users). The normal sequence is select target, move right to the keypad (OK for most eurpean settings), but then back left again for SET button, perhaps the last a little unnatural. Again linking the three sub-panels with a drawn box or colouring them could increase the emphasis that they have a common function. The main sequence/grouping problem is that they are only enabled in red mode hence changes to them involve going back and forth across the control room.  
In general it seems the uniform size of the sub-panels is causing some problematic design choices..
- (iii) See next sheet
- (iv) oops I've answered some of that in the above (so may students and I'll watch for it). Have a separate CONFIRM button on the Alarm control panel, making it flash so it is more raedily seen in peripheral vision. Distinguishing red from temporary red state by perhaps flashing the red light would also help prevent the initial mode error. Also, when the user tries to select a target and enter a value, a warning of some sort should be issued. This could simply be a 'this doesn't work' beep, but better would be a warning written on the manual override panel with perhaps lights up when not in RED alarm state.

## Answer 4 continued

### Annotated scenario for Q4 part iii

[[ *Original text in italics to aid reading, the expected answer is in normal type. This is a very full answer. This situation mirrors quite closely a mode and closure error in Excel that we discussed at length in class.* ]]

Note: Jenny has been 6 hours on a night shift, so errors are likely especially under stress.

1. *Jenny notices the core reaction rate has risen very rapidly*  
one perhaps wonders why this wasn't noticed earlier, perhaps a problem in positioning of displays?
2. *she realises she must immediately change the reactor target ...*  
OK
3. *she goes to the Alarm Control Panel ... presses '+' twice*  
Jenny has remembered that she needs to be in RED state to use manual override
4. *the Emergency Confirm button glows red*  
OK, Jenny should press CONFIRM now, but having pressed then '+' and seen the RED alarm state light glow she gets the 'aha' feeling of closure and forgets to press CONFIRM. The red is CONFIRM button is intended to remind her but ...
5. *she moves across to the Manual Override panel ...*  
clearly Jenny didn't notice the CONFIRM button, presumably because it is at the bottom of the panel and she is looking at the Alarm control at the top. Peripheral vision is good at black and white (contrast) changes, but not colour.
6. *she selects 'Pressure' from the pull down on the Manual Override panel*  
which won't work because she is in the wrong Alarm state – this is a mode error caused by the original closure error, but when she is at the far left of the control panel the current system mode (temporary red alarm state) is not visually (or audibly clear).
7. *she types the new value '6000' using the keypad*  
and forgets to press SET – another a closure error
8. *she notices that the number on the Reactor Targets panel has not changed*  
happily she does double check this rather than simply moving on which would have easily been possible
9. *she realises she forgot to press the SET button on the Manual Override panel*  
OK realises this one, perhaps because of better logical grouping
10. *she presses the SET button*  
OK, but ...
11. *the value still doesn't change*  
still in wrong mode (alarm state temp red)
12. *an automatic audio warning sounds "60 seconds to core meltdown"*  
good choice of warning modality to use sparingly for critical information. In a big control room a visual alarm would easily be missed.

#### Answer 4 continued ...

#### Annotated scenario for Q4 part iii, continued ...

13. *she presses the SET button repeatedly*  
typical user reaction, happily doesn't cause bad effects!
14. *still the value doesn't change*  
still in wrong mode and despite repeated failure still doesn't think of a mode error – which is normal behaviour in error situations – the expected mode is part of the assumptions she brings to her problem solving
15. *she starts again, selects 'Pressure' from the pull-down, types 6000 and presses SET*  
presumably thinking that the previous part-finished action sequence before 'confused' the system
16. *still the value doesn't change*
17. *the audio warning says "30 seconds to core meltdown"*
18. *Jenny runs across the room to the Emergency Shutdown panel*  
no, still doesn't realise that the problem is the wrong alarm state, but now aiming to shutdown the reactor to avoid meltdown
19. *"20 seconds to core meltdown"*
20. *she presses "Immediate Emergency Commence" button*  
correct action in dire emergency
21. *the emergency confirm button glows red*  
but this time is close to the button she has just pressed (in fact it would have already been glowing when she got there but perhaps didn't notice as she was running and stressed) and so this time she notices the CONFIRM button ...
22. *"10 seconds to core meltdown"*
23. *she presses the "Emergency Confirm" button*  
... at last!
24. *she hears the crash of the explosive bolts ...*  
actually there is nothing quite so good as real physical feedback whether visual, tactile or, as in this case, audible
25. *the audio system announces "reactor shutdown successful"*  
but restarting the reactor will take weeks costing vast amounts of money!

## Sample Answer 5

The missing state variables probably only become apparent when attempting to describe actions, but you can't describe actions without state, hence the advice.

### (i) State description

```
Alarm_State:    {Green, Amber, TempRed, Red}
Confirm_Needed: Boolean      [ that is true or false]
Target_Pressure: Nat         [ that is { 0, 1, 2, ... } ]
Target_Temp:    Nat
Target_Flow:    Nat
Manual_Override_Value: Nat
Target_For_Override: { Pressure, Temp, Flow }
Shutdown_State: {Normal, Waiting_Confirm, Confirmed}
```

Although it would be possible not to have the Confirm\_Needed flag and instead use the states of the Alarm\_State and Shutdown\_State, I have recommended using such flag variables to encourage clarity, rather than relying on complex cases involving 'special values'.

### (ii) Completed state change descriptions

#### **confirm**

```
set Confirm_Needed to false

if ( Alarm_State is TempRed )
then set Alarm_State to Red

if (Shutdown_State is Waiting_Confirm )
then set Shutdown_State to Confirmed
```

#### **cancel**

```
set Confirm_Needed to false

if ( Alarm_State is TempRed )
then set Alarm_State to Amber

if (Shutdown_State is Waiting_Confirm )
then set Shutdown_State to Normal
```

## Answer 5 continued

### (iii) Additional state change operations

#### **alarm\_higher** [plus key is pressed]

```
if ( Alarm_State is Red or Alarm State is TempRed )
then do nothing

if ( Alarm_State is Amber )
then set Alarm_State to TempRed
and set Confirm_Needed to true

if (Alarm_State is Green)
then set Alarm_State to Amber
```

#### **shutdown** [IMMEDIATE SHUTDOWN COMMENCE button pressed]

```
if (Shutdown_State is Normal )
then set Shutdown_State to Waiting_Confirm
and set Confirm_Needed to true

otherwise do nothing [N.B. don't go from Conformed to Waiting!]
```

#### **select\_target(targ)** [the target pulldown has been used]

```
set Target_For_Override to targ
set Manual_Override_Value to zero
```

#### **set\_target\_value** [the SET button has been pressed]

```
if ( Alarm_State is not Red )
then do nothing

otherwise ...

if (Target_For_Override is Pressure )
then set Target_Pressure to Manual_Override_Value

if (Target_For_Override is Temp )
then set Target_Temp to Manual_Override_Value

if (Target_For_Override is Flow )
then set Target_Flow to Manual_Override_Value
```



## Answer 5 continued

(iv) annotated scenario

Initial state:	Alarm_State is Green Confirm_Needed is false etc. ...
Steps 1, 2	– no system actions
Step 3	– press '+' twice <b>alarm_higher:</b> Alarm_State = Amber <b>alarm_higher:</b> Alarm_State = TempRed Confirm_Needed = True
Step 4	– button glows because Confirm_Needed = True
Step 5	– no system action
Step 6	– select pressure <b>select_target(Pressure):</b> Target_For_Override = Pressure Manual_Override_Value = 0
Step 7	– types the new value '6000' <b>Keypad_digit(6):</b> Manual_Override_Value = 6 <b>Keypad_digit(0):</b> Manual_Override_Value = 60 <b>Keypad_digit(0), Keypad_digit(0):</b> Manual_Override_Value = 6000
Step 8, 9	– no system action
Step 10	– presses the SET button <b>set_target_value:</b> nothing happens (Alarm_State not Red)
Step 11	– no system action
Step 12	– system action outside control panel being modelled
Step 13,14	– as with step 10,11 nothing changes
Step 15, 16, 17	– as steps 6, 7, 10, 11 and 12
Step 18	– no system action
Step 19	– as step 12
Step 20	– presses "Immediate Emergency Commence" <b>shutdown:</b> Shutdown_State = Waiting_Confirm Confirm_Needed = true
Step 21	– button glows because Confirm_Needed = True
Step 22	– no system action
Step 20	– presses "Immediate Emergency Commence" <b>confirm:</b> Shutdown_State = Confirmed Confirm_Needed = false
Step 24, 25	– action outside description of control panel (but v. important!)