Formal Requirements

Section 2)

Develop a computer version of the classic game Property Tycoon. This real social experience game was originally designed for up to 6 players, however the computer version of the game includes the option for a computer program to take the role of one or several players making it playable for smaller groups.

Requirement:

* Up to 6 players (if there’s not enough players, a computer program can play as one or several players.

Section 3)

Rules of Property Tycoon:

Requirement:

* Game players requirement: 2-6 players (computer program as players if not enough)
* Each player is assigned with a game token: boot, smartphone, goblet, hatstand, cat, spoon
* Players take turns in rolling 2 dice to determine movement around board (clockwise)
* All players start on space labelled “Go”
* Each player starts of with £1500 cash, (players can’t borrow additional money from the bank but can trade items with the bank)
* 1 player is designated as the banker, they are responsible for distributing the correct amount of cash to each player (the bank has £50,000 cash).
* There are 2 packs of cards, “Pot Luck” and “opportunity Knocks” when cards are picked they have to be replaced at the bottom of the corresponding pile
* Getting a double allows the player to take another turn, a third double results in going to “jail”. When a player goes jail they go directly and don’t pass “Go”
* Board consists of space for “pot luck”, “opportunity knocks”, “free parking”, “jail/just visiting” (instructions must be specified for player to follow.
* If a player lands on “pot luck” or “opportunity knocks” they must take a card from the top of the corresponding pile and carry out the instructions of the card (card must be then placed at bottom of the correct pile).
* Players can’t buy a property until they have completed one circuit of the board.
* Going past “Go” you are rewarded £200 from the bank
* At the start the bank owns all properties, when a player purchases a property then the bank transfers the card to the player and the amount on the card is paid to the bank
* If a player lands on a property they can decide to purchase it or not. If they don’t then the property is auctioned by the bank allowing each player to make a bid, highest bid wins the property. (no bids results in no sale) Bidding players must have completed a circuit!
* Landing on someone else’s property results in the player paying the rent shown on the card to the owner
* If a player owns properties in a colour coded group but doesn’t develop houses or hotels then rent due is doubled (otherwise rent due is shown on card as original)
* Rent must be paid in cash, if a player can’t pay then they must sell their assets to pay. After selling if they still cant pay the rent then they’re declared bankrupt and must leave the game (game token is then removed from the board)
* Players can’t lend or borrow money from each other or the bank
* Once a player has moved their token and has completed property purchases, they have the opportunity to improve their properties, however after this they can’t improve their property anytime after.
* If a player owns properties of a particular colour coded group (all same colour code) they can build houses and hotels, otherwise they can’t
* If a player wants to raise funds they can sell a property to the bank to its original purchase price. This can only be done if no houses or hotels have been built on the property.
* A player can also sell houses or hotels to the bank for its original purchase price
* If a player owns a coloured set of properties, there may never be a difference of more than 1 house between the properties. (A hotel is worth 4 houses)
* Maximum development on a property is 1 hotel
* To raise funds a player can get a mortgage from the bank worth half the purchase price of the property (player can’t collect rent at this point)
* If a property is then sold back to the bank, the bank pays the other half of the original purchase price
* When fines are paid the proceeds add up on the free parking space on the board. When a player lands on free parking they collect all the funds there
* A player can be released from jail by paying £50. This £50 is added to the free parking fines space and the players token is moved to “just visiting”.
* If a player opts to stay in jail they miss the next 2 rounds. In jail a player can’t collect any rent from other players. After the 2 rounds is up they are moved to “just visiting” and their turn is finished.
* If a player has a “get out of jail free” card they are moved to “just visiting” and their turn ends. The card is then placed at the bottom of “pot luck” or “opportunity knocks”.

2 Different game versions:

* Full Game: game is played until 1 player is left and the other players have retired from the game because of bankruptcy or because they have decided to leave the game with a agreement of other players. If they decide to leave the game with a agreement of other players then all their properties and funds are given to the bank.
* Abridged Game: A time limit is set at the beginning of the game by all the players. Once the limit is reached and all the players have taken the same amount of turns each then the game ends. Assets of each player is calculated and the player with the most valued asset is the winner.  
   Value of a players asset is calculated in the following way:  
   - cash held  
   - property value (game card value unless the property is mortgaged then its half the value).  
   - value of houses and hotels purchased for properties, “Get out of jail free” and other cards have no cash value.

Section 4-7:

Clarifications (18th Feb):

Q) Does currency come in the form of 1,5,20,50,100 and 500 pound

denominations, or can currency be treated as a series of single pounds?

A) Unlike the board game, money can just be treated as a single value. There

is no need to model the individual notes.

Q) Can you tell us more about how you want the banker to function in game?

Can the Banker cheat? Or does the banker just press the set buttons to fulfil

transactions? In essence does the game enforce the rules upon the banker so

the banker can never make a mistake or cheat?

A) The banker is totally honest, independent and never makes mistakes.

Q) During bidding can a player sell some of their properties in order to make a

higher bid?

A) A player cannot sell assets outside of their turn. Bids have to be made

using cash assets in their possession at the time the bid is made.

Clarifications (19th Feb):

Q) Amount of players. The game was limited to 6 players as the bank had a

finite amount of money, are we following the 6 player maximum rule? If so,

would expansion of player quantity limit be something you may look at in the

future?

A) We did some thinking on this. The current game has a limit of 6 players

imposed by the player tokens. There is no particular reason why it can't be

more than 6, but in practice we found that with more than 6, the chances of

any player actually winning was too low and made the gameplay boring. So 6

will remain the maximum number of players.

Q) If there is the ability to add more players, could you suggest more player

piece objects; further to the hatstand, spoon, etc. Alternatively, we can

incorporate a way of adding pieces at any time.

A) Whilst there are no more players, it might be nice if the pieces could be

customizable.

Q) Can players trade with each other? Having played the game, we found that

without players being able to trade properties for other property of money, the

game does not conclude, as it is rare for players to get a whole street.

A) We are thinking about this one, and will send out further guidance at a later

date.

Q) Is there no set layout for special tiles like jail, free parking, etc?

A) We are unclear what this question is asking.

Q) What does "Other instructions" mean, when referring to the "Pot luck"/

"opportunity knocks" cards or special board squares? Can we narrow this

down, as in order to create the game, we must have this narrowed down to a

task, for example "pay", "receive". This information will allow us to give more

functionality to new special board squares and "Pot luck"/ "opportunity knocks"

cards.

A) See the Action column in the cards spreadsheet.

Q) Is there a starting price for an auction, or does the price begin at 0?

A) The starting price should be £1.

Q) What "Assets" can the bank buy?

A) Any property asset, house or hotel. Get out of jail cards and the tokens

have no value.

Q) What happens to a player's assets if they can't pay another player? Are

they mortgaged, then passed on to the player that they owe money?

A) Assets are sold to the bank to raise cash to pay the player. If a player

cannot raise enough cash, all the cash proceeds from sale of assets to the

bank is paid to the player and the bankrupt player retires from the game.

Q) Is a property that goes back to the bank auctioned or goes back to being

for sale when someone lands on the property?

A) The property becomes available for sale when someone next lands on that

property.

Q) It states a hotel is worth 4 houses, so can you have two houses with 3

houses and one with a hotel?

A) No, the maximum difference between improvements on one colour group is

one house. So you can have a hotel on one, and four houses on the others.

We could have been more clear on this point in the specification. To buy a

hotel costs effectively the price of 5 houses. We will update the original

specification in respect of this point shortly.

Q) Can we have some more detail as to which fines go to free parking. What

money goes to the bank, and what goes to free parking?

A) This information is contained in the Card Data spreadsheet. Under the

Action column, it clearly states when money is paid either to the bank or the

free parking space.

Q) It says there is a free parking square in the centre of the board, is this

along side a free parking square on the playable board (The squares the

player will circulate)?

A) In the original game, the fines collected for free parking area placed on a

space in the centre of the board. This is n addition to the space on the main

board.

Q) Does a player have the option to pay the £50 to get out of jail the second

they go to jail, or on the next turn?

A) Yes, they can opt to pay the fine immediately. Their token is then moved to

free parking and they move on their next turn.

Q) The specification says "Get out of jail on two turns", do you roll on the third

and move along the board or get out on the third?

A) You get out on the third. So your token moves to just visiting and then you

make a move as normal on the next turn.

Q) Do you have to use a get out of jail free card?

A) No. But it has no resale value.

Q) . Can you withdraw from the abridged version?

A) A human player may withdraw from either version of the game at any time.

If they withdraw for any reason, all their assets are returned to the bank. A

player game agent may not retire of its own choosing for any reason

whatsoever.

Q) "Fun to play" and "Reflects the spirit and character of the game" are both

very ambiguous phrases, do you have some clarity for this either textually or

in the form of examples as to what you are requesting with these phrases? If

these phrases cannot be reworded, we politely request that they are removed

from the specification, to be replaced with with a more suitable outline of the

graphics/interface.

A) But these are our requirements! This what we need. That's why we put

then in the document. Try asking more specific questions.

Clarifications (25th Feb):

Q) Can the user customise the amount of tiles, i.e removing tiles wholesale

from the spreadsheet or adding their own tiles?

A) The amount of tiles should remain fixed as in the original game.

Q) Can the user modify the names/group/action/cost of the tiles? If so,

especially in terms of action, how should we expect the input should be

formatted? i.e will "pay" before a pound value always mean to take away

money from the current player?

A) If it’s a player paying the rent, it comes from the current player assets. If it’s

the ban paying, then the money comes from the bank assets.

Q) Can the user modify the 'rent' of the utilities, stations and property tiles? If

so what standard input should we expect to receive from the utilities and

stations notes section in order to know how to modify their rent?

A) The rent is set at the time the game is initialized. The rents are initialized at

whatever value was contained in the external configuration file.

Q) Can the user adjust the price of house and hotel costs?

A) No. The prices are set as part of the original game.

Q) Is there a limit on the total number of hotels/houses available for purchase

like in the original game of monopoly?

A) Watson Games is committed to the construction of affordable housing so

there does not seem to be any useful limit in this respect.

Q) Following on from that if there is a limit, would it go against your definition

of the spirit of the game for a player to hoard houses when there are none left

so that other players can't buy any?

A) Hoarding houses is a mean trick.

Q) We're assuming that the purple properties at positions 12, 14 and 15 are

a different group from those at 38 and 40. Is this correct?

A) The Excel sheet has been updated to correct this error. Please download

the latest version.

Clarifications (1st March):

Q) Are tokens allocated to players randomly or can players choose?

A) It would be nice to be able to choose (you can in real life). But equally a

random option is useful when players don’t care.

Q) Should we implement a timer/turn limit for the players on the abridged

version? - A timer specifically so people cannot get into the lead then waste

time.

A) A timer would be in the spirit of the original game. “Filibustering” is for cads

… [NB: look these words up in a dictionary …]

Q)Can we automate the bank?

A) As long as the bank does the job intended for it.

Q)Can players sell back properties to the bank or only mortgage them?

A) Good point. A player is free to sell a property to the bank for the price paid

originally for it. A property may only be sold when it is free of houses and

hotels, when it is the player’s turn. When a property is sold, no

improvements are possible in that colour group. A player must own all of

the properties in a colour group before any improvements can take place.

Quentin Raffles

Further info from Kingsley Sage

Q) In the example on Study Direct, the functional requirements were

organised into very high level APIs that grouped the functions of the software

into "Game Requirements", "World Requirements" etc, is it okay to use this

type of API approach for the formal document with Property Tycoon? Our

team have identified many functional requirements but can't find a better way

to organise the document other than this grouping approach. I'm worried it

implies an object oriented design even though the requirements aren't

supposed to indicate how the software will be designed!

A) The grouping is just a means of helping to organise a large amount of

information in a logical manner. A requirements document and its structure

have no specific bearing on an OO design. The design documentation that

follows the requirements process does. The same requirements doc can be

used to create both OO and plain procedural solutions.

Q) If we translate the domain requirements later on in the project (e.g. a few

weeks later during actual coding) into functional/non-functional requirements,

do we need to change the requirements document to reflect this?

A) If the changes are significant, it would be a good idea. But you could also

just add an addendum to the original document rather than rewriting the whole

thing. As long as your keep track of your requirements somehow, you should

be fine. A good numbering scheme helps a lot.

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| Requirement Name | Operating system (**NF1.1**) |
| Description | The game shall run on Windows desktop operating systems. |
| Test case (if applicable) | Does it run on Windows, passes if yes, fails if no |
| Language/Software use (if applicable) | Windows (language not specified, should be Java for cross platform) |
| User requirement | The electronic version should be for desktop machines, and ideally should be playable on both Mac and PCs. If this is difficult, then PC development should be preferred. |

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| Requirement Name | Operating system (**NF1.2**) |
| Description | The game should run on MacOS operating System devices |
| Test case (if applicable) | Does it run on Mac, passes if yes, fails if no |
| Language/Software use (if applicable) | Mac (language not specified, could be Java for cross platform) |
| User requirement | The electronic version should be for desktop machines, and ideally should be playable on both Mac and PCs. If this is difficult, then PC development should be preferred. |

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| Requirement Name | Judging entertainment value (**D1**) |
| Description | Game should be fun, and similar to the original Property Tycoon game. |
| What to take into account | This is hard to quantify, but may be useful to run user tests when the first prototypes are done |

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| Requirement Name | AI Players (**NF2**) |
| Description | There should be a ‘computer’ player in the game, that can take over as one or more players. |
| Test case (if applicable) | Can the game be played by two or more computers against one another? |
| Language/Software use (if applicable) | N/A |
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| Requirement Name (and number) | AI variants (**F1**) |
| Text (That the requirement is based on) | Such simulations also offer a means of testing the performance and correct operation of your game. |
| Description (of what requirement does) | There should be multiple player types that respond differently to specific situations, so that the best strategy can be identified |
| Inputs | UI to add, and select multiple different player characters, that have distinct priorities |
| Outputs | Different results when playing the game, according to the priorities |
| Errors possible | Multiple |

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| Requirement Name (and number) | Accessing initial game info (**F2**) |
| Text (That the requirement is based on) | A means of uploading initial data: to get the simulation started you will need a means of initialising it with data on the board layout, the “pot luck” and “opportunity knocks” cards and the details about the various properties (the data that is currently on the cards in the physical version of the game. This data will be provided to you in the form of a set of one or more Excel spreadsheets. As this data will be loaded on start-up from external files, this means that the game is easily customised and Watson Games see this as a valuable selling point of the new electronic version. |
| Description (of what requirement does) | The initial game information must be uploaded from excel sheets, this includes:  Board Layout  Pot luck cards  Opportunity knocks cards |
| Inputs | Excel sheets as input files for specific information |
| Outputs | Different places on the board, and different cards |
| Errors possible | The cards may not read the correct information, or the game may not know what to do with the information. |

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| Requirement Name (and number) | Performance monitoring (**F3**) |
| Text (That the requirement is based on) | A means of monitoring the performance of the simulation |
| Description (of what requirement does) | A ui element that allows each player to see how the other players are doing, this means current property ownership, and monetary value at any point in the game |
| Inputs | None |
| Outputs | UI elements that display specific, yet necessary information, when requested |
| Errors possible | Incorrect values shown, or UI may not work |

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| Requirement Name (and number) | Test suite (**F4**) |
| Text (That the requirement is based on) | A means of being tested |
| Description (of what requirement does) | A fully functioning test suite, of Unit and Integration tests, so that each section of the code in the game can be tested |
| Inputs | Test cases |
| Outputs | True or false returns, with error messages if something fails, so that it can be corrected |
| Errors possible | Useless tests, or incorrect test methods applied |

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| Requirement Name (and number) | Game player agent capabilities (**F5**) |
| Text (That the requirement is based on) | The game player agent should be able to play the game to the same extent that a human player would. |
| Description (of what requirement does) | A game player must be able to act as a human player would, they mustn’t have the same skill or intuition as a human player, yet it is necessary that they can do the same actions |
| Inputs | Game player |
| Outputs | Game playing itself as a normal player would |
| Errors possible | Some section of the game is blocked off to the player |

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| Requirement Name (and number) | Bank resources (**F6**) |
| Text (That the requirement is based on) | The Bank has unlimited resources |
| Description (of what requirement does) | The bank would never run out of money, so that there is an unlimited amount |
| Inputs | N/A |
| Outputs | The bank must give the players as much money as they are required to get |
| Errors possible | There’s a limit to the amount |

Possibility: have a separate game mode where the bank hands out iou’s instead of having unlimited money

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| Requirement Name | No lending money (**NF4**) |
| Description | There is no possible way for players or the bank to lend money |
| Test case (if applicable) | N/A |
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| User requirement | Player may not borrow or lend money to one another. All assets procured from the bank must be paid for in cash. The bank does not provide credit. |

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| Requirement Name (and number) | Property ownership (**F6**) |
| Text (That the requirement is based on) | Property ownership is part of the public record |
| Description (of what requirement does) | If a property is owned by any player, it must be easily disclosed, and viewable by every other member on the board. This can be disclosed at any moment in the game |
| Inputs | Request for information |
| Outputs | Information on property ownership |
| Errors possible | Request denied, or inaccurate information shown. |

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| Requirement Name (and number) | Fair dice (**F7**) |
| Text (That the requirement is based on) | The dice must be fair |
| Description (of what requirement does) | There must be an equal chance that the dice roll each number, if not the game would become unfair |
| Inputs | N/A |
| Outputs | The bank must give the players as much money as they are required to get |
| Errors possible | There’s a limit to the amount |

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| Requirement Name | Banker integrity (**D2**) |
| Description | The banker is responsible for giving the correct money from the bank to the players, and cannot cheat or make mistakes. |
| What to take into account | The banker has to be designed with these requirements taken into consideration. The banker role is mandatory, and can be automated (see Clarifications, 1st March) |

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| Requirement Name (and number) | Improvement differences on a colour group (**F8**) |
| Text (That the requirement is based on) | The maximum difference between improvements on one colour group is one house. |
| Description (of what requirement does) | i.e. you can have a hotel on one, and four houses on the others, but not a hotel on one and three houses on another. |
| Inputs | Test cases. |
| Outputs | Desired or undesired results, followed by further modification and tests in the latter situation. |
| Errors possible | Incomplete tests; ensure that both human and AI players have to adhere to this rule. |

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| Requirement Name (and number) | Withdrawing from the game (**F9**) |
| Text (That the requirement is based on) | A human player may withdraw from either version of the game at any time. |
| Description (of what requirement does) | If they withdraw for any reason, all their assets are returned to the bank. A  player game agent may not retire of its own choosing for any reason whatsoever. |
| Inputs | Test by withdrawing in both versions. |
| Outputs | Desired or undesired results, followed by further modification and tests in the latter situation. |
| Errors possible | Being unable to withdraw in either version; a player game agent being able to retire of its own choosing; game crashes or glitches after a player retires. |

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| Requirement Name (and number) | Follow Original Monopoly Integrity (**F10**) |
| Text (That the requirement is based on) | A vast majority (approx. 90%) of the clarifications restate rules and functions based on how they exist in the original Monopoly. |
| Description (of what requirement does) | Create the game while adhering to these Monopoly rules and applying them in the game. Including these rules in the code and thoroughly testing them is extremely important. |
| Inputs | Thorough testing of each rule. |
| Outputs | Desired or undesired results, followed by further modification and tests in the latter situation. |
| Errors possible | Potentially missing a rule, misunderstanding a rule, or coding a rule incorrectly. |

--------------------------UPDATE (23/04/18)-----------------------

The representatives of the Property Tycoon Players Club have made some amendments to the original user requirements.   
They have suggested there should be an option to allow players to trade properties, however they don’t want to upset loyal players so therefore they have suggested that a option should be available before the game is started, to play the full or abridged game.   
This is a simple trading system allowing users to trade, however they can only trade if they don’t have any debts or fines. Trade offers can be declined!  
- Trades must only be property for property, not for cash! The player can determine whether the trade is acceptable or not.

* The game should not be customisable by the user colour wise (therefore they shouldn’t be able to alter the original monopoly game colours, e.g. board colours etc.
* (informal note) The excel file doesn’t have to be read through excel, can reformat and use a different platform for the compiler to read the information.  
  (overall don’t deviate from the original game rules - no user changes to be made)
* The user should not be able to alter the game play, e.g. collect $300 instead of $200 at Go, this should not be allowed as it deviates from the original monopoly game.
* In regards to trading, own viewpoint can be taken on this. Could only allow the purchase of a property first before user can trade on their next turn (realistically should wait one iteration before they can do something else).
* For the trading system, a simple accept/reject option is sufficient. (Could add a more complex choose but accept/reject seems sensible).
* When a user is leaving jail they should be moved to “Just Visiting”, previous mistake in requirements suggested user to be moved to “Free Parking” but this is not the case, they should be moved to “Just Visiting”.
* (Bidding System) When players bid in auctions, make sure each players bids is not shown all on screen at once. Instead when a player bids, they should be shown their own bid and if they’ve been outbid or if they’re top bidder.
* (Bidding System) Auction should only be made if 3 or more players are bidding, so not if there's only 2 users bidding.
* For a player to take part in a auction they must have passed “Go”, therefore before a auction can take place, 3 players must have passed “Go”.
* A player can’t join in on the auction if he/she is in jail.

* (Property sale) If a player is selling a property to the bank and its a un-mortgaged property then they receive 100% of the price they bought the property for.
* If a player decides to not buy a property they can’t be allowed to partake in a auction for that property.
* A player can purchase houses and hotels at the end of their turn, but they can only buy up to 4 houses on any one property and the maximum number of hotels on any one property is 1.

Debt

* If a player has £100 and properties worth £300 but they owe another player £2000, they sell their properties and pay the other player £400 and they they are removed from the game. The other £1600 owed to the player is not longer taken into account (isn’t paid)

Jail

* If a player is sent to jail, they can pay £50 immediately to get out.

Property mortgage

* When a player owns all the properties with the same colour and he/she mortgages one of them the rent of them will still be doubled however rent is not payable when a player lands on a mortgaged property.

(Didn’t get what they meant by this so I’ll put it here and mention it in the group)  
“ Q) We know that we can set the start player as who got the highest score of dice at the beginning, but how about the order of second, third and other players? Clock-wise or second/third highest score of dice? Or is it also in the spirit of the original game?

A) You may choose any reasonable strategy as you see fit. “